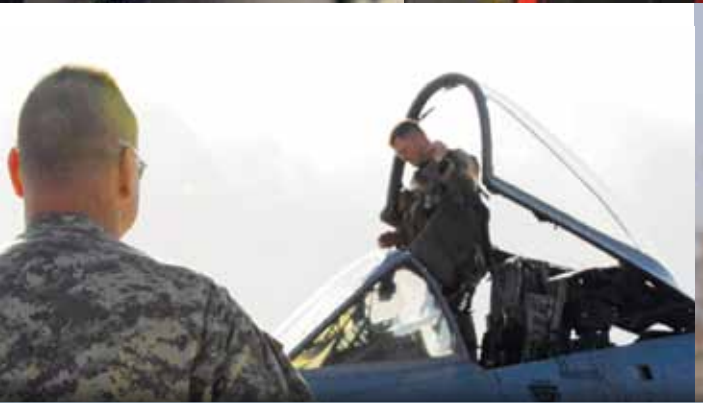


Human Systems Integration (HSI) in Acquisition

Integrating Human Concerns into Life Cycle Systems Engineering

Acquisition Phase Guide

HSI Domain and Management Guides also Available

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 2009	**Final**	**00-00-2009 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Human Systems Integration (HSI) in Acquisition (Acquisition Phase Guide).	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Larry Carr; Frances Greene	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
(Lead) Survivability/Vulnerability Information Analysis Center (SURVIAC),Booz Allen Hamilton (BAH),2700 D. Street / Bldg 1661,Wright-Patterson AFB,OH,45433-7404	**; AFHSIO-004**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
Air Force Human Systems Integration Office, 5201 Leesburg Pike / Suite 1501, Falls Church, VA, 22041	**AFHSIO**
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)
	AFHSIO-004

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

Acquisition Phase Guide, Human Systems Integration, HSI, Analysis of Alternatives, Capability Development Document, Initial Capabilities Document, Life Cycle Management Plan, AoA, CJCSI, DoD, DoDI 5000.02, ESOH, ICD, LCMP, MER, SE, SEP, SME, SURVIAC.

14. ABSTRACT

Human Systems Integration (HSI) encompasses the interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice. HSI processes facilitate trade-offs among human-centric domains without replacing individual domain activities, responsibilities, or reporting channels. The human-centered domains with recognized application to HSI include: Manpower, Personnel, Training, Human Factors Engineering, Survivability, Environment, Safety, Occupational Health, and Habitability.

15. SUBJECT TERMS

Acquisition Phase Guide, Human Systems Integration, HSI, Analysis of Alternatives, Capability Development Document, Initial Capabilities Document, Life Cycle Management Plan, AoA, CJCSI, DoD, DoDI 5000.02, ESOH, ICD, LCMP, MER, SE, SEP, SME, SURVIAC.

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**1**	**184**	

Acknowledgement: This product was greatly improved through the contributions of the following people: Daniel Badger, Jim Barnaba, Debbie Burdich, Gloria Calhoun, David Carpenter, Gregg Clark, Barry Craigen, Eric Crawford, Greg Edwards, Jennie Farrell, Curtis Fey, Richard Freeman, Guy French, Hugh Griffins, David Hardy, Nate Herro, John Joyce, Fred Juarez, Keith Kidder, Jim Kinzig, William La Fountain, Kristin Liggett, David Louis, John Maziarz, Dawn McGarvey-Buchwalder, Michael Mueller, Oscar Payan, Carlene Perry, Bryan Ramstack, Tommy Ray, Kurt Spilger, David Walker, William Weidenhammer, Gary Wright, Richard Ziglar

Source Disclaimer: Definitions for acronyms, terms, and tools used in this product came from a variety of Department of Defense sources including Department of Defense Instruction (DODI) 5000.02 and the Defense Acquisition Portal. Definitions for human systems integration and its related domains were taken from the International Council on Systems Engineering (INCOSE) Systems Engineering Handbook v3.1 Appendix M, August 2007. Tool descriptions were taken from the Directory of Design Support Methods and in some cases from tool web sites. Photography was provided by the Air Force.

This product was produced for the Air Force Human Systems Integration Office (AFHSIO) by Booz Allen Hamilton under the auspices of the Survivability/Vulnerability Information Analysis Center (SURVIAC). Requests for copies and any other questions should be sent to: AFHSIO, 5201 Leesburg Pike, Skyline 3, Suite 1501, Falls Church, VA 22041-3202 or Email: hsi.workflow@pentagon.af.mil

August 2009

HSI in Acquisition

Integrating Human Concerns into Life Cycle Systems Engineering

Air Force Human Systems Integration Office

Disclaimer: This product contains references to existing and emerging tools currently available and/or in use in Government, academia, and industry. The tools listed are illustrative of what can be used to perform the identified activities and are not exhaustive due to the volume of tools available. The Air Force Human Systems Integration Office, the Air Force, and the Department of Defense do not endorse any specific contractor or commercial product.

Executive Summary

Human Systems Integration (HSI) encompasses the interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice. HSI processes facilitate trade-offs among human-centric domains without replacing individual domain activities, responsibilities, or reporting channels. The human-centered domains with recognized application to HSI include: Manpower, Personnel, Training, Human Factors Engineering, Survivability, Environment, Safety, Occupational Health, and Habitability.

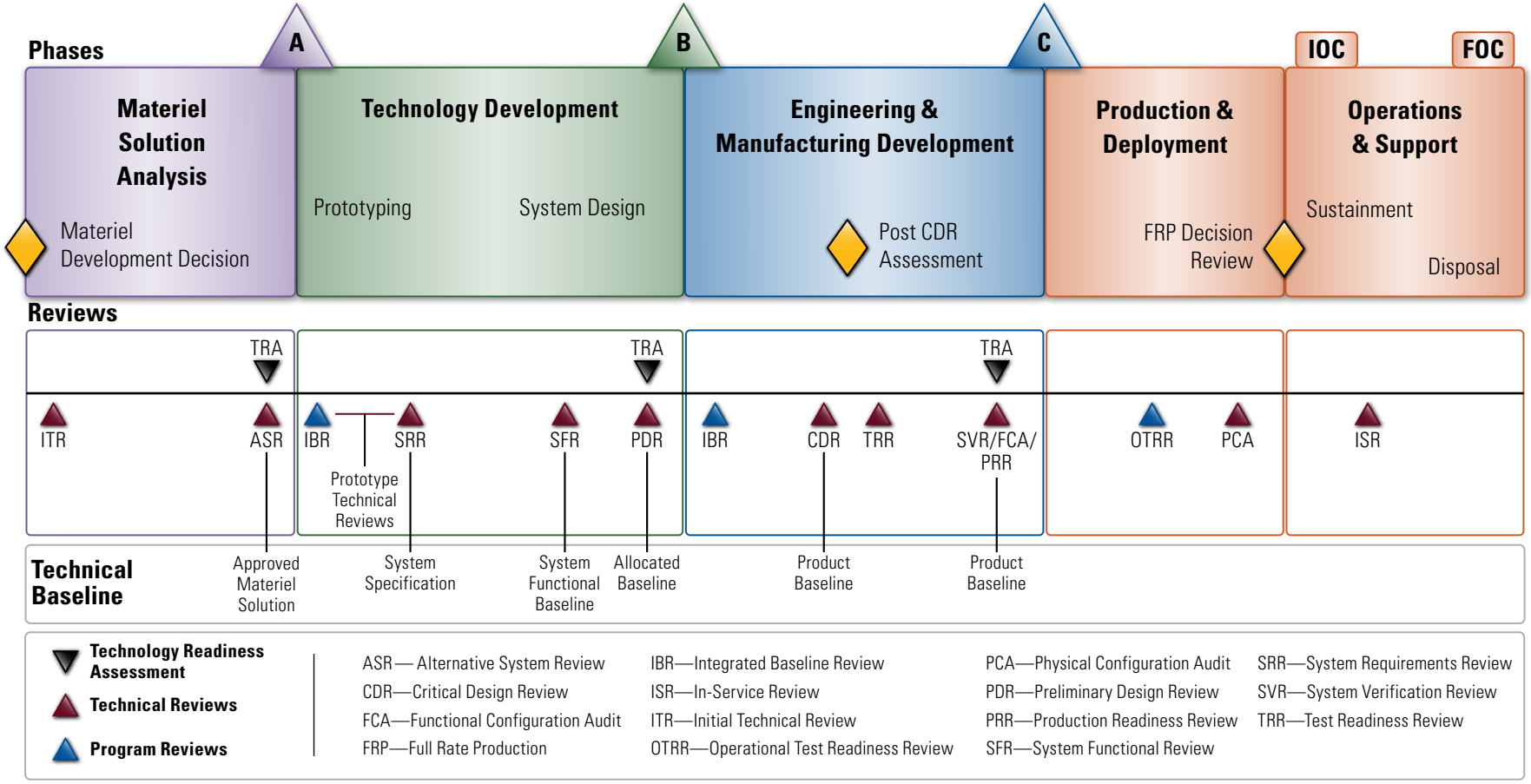
The goal of HSI is to maximize total system performance, understanding that the human element is an integral part of systems, while minimizing total ownership costs. To be effective, HSI must be conducted as a fundamental part of the overall systems engineering activities within the Air Force Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. HSI activities will focus on overall system performance and also on the design and integration of many subsystems, thus making HSI a critical part of the design process.

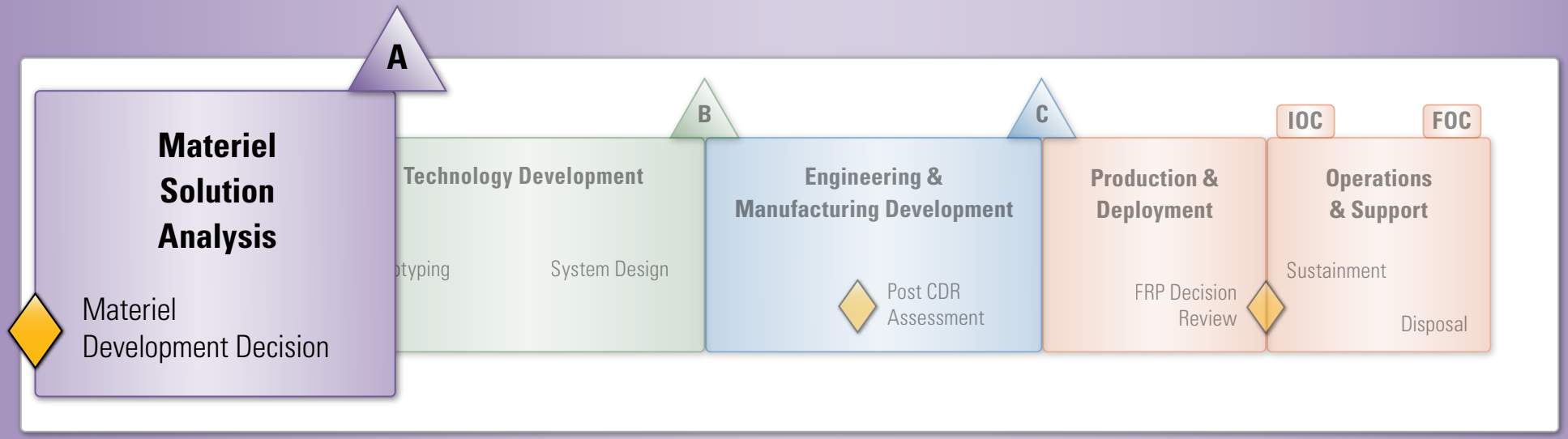
This guide assumes a basic understanding of DoD Systems Engineering (SE), HSI principles and practices, and acquisition acronyms and terminology. It was developed to depict when HSI activities should be performed to influence system design throughout the SE process. Its purpose is to facilitate domain and systems engineering integration on HSI issues.

Relevant tasks, tools, and references for HSI and each of the HSI process domains are identified and aligned with existing SE processes and reviews for each acquisition phase. Many of the tasks identified are notional best practices and not all tasks would be performed with every acquisition program.

Three versions of this guide have been produced. This version is organized by acquisition phase. Another version organized by domain is also available as well as a separate, shorter management version which focuses solely on HSI activities. Copies of the other versions can be obtained by contacting AFHSIO.

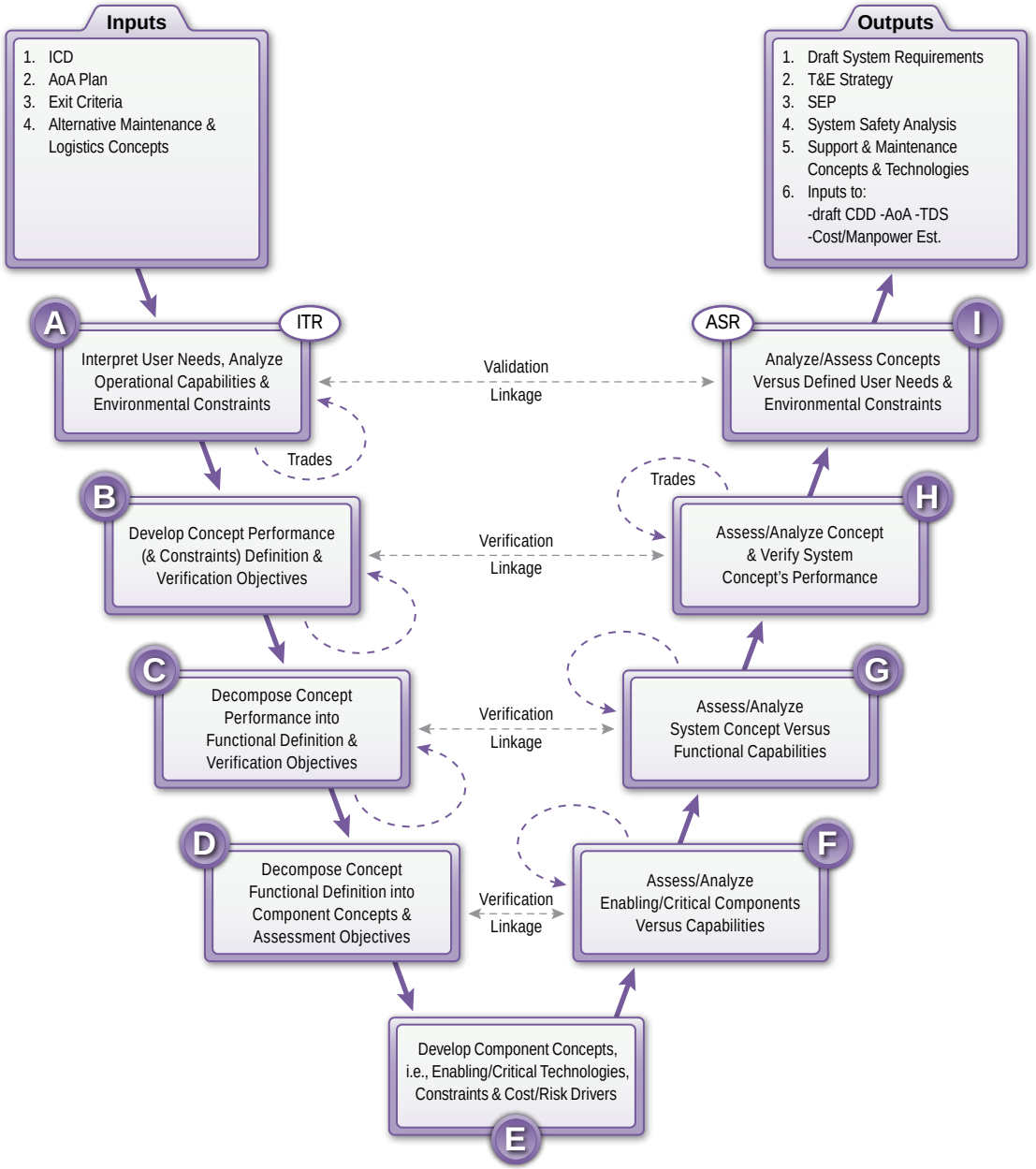
Acquisition Life Cycle and Systems Engineering Technical Review Timing





Materiel Solution Analysis—The purpose of this phase is to assess potential materiel solutions. The Materiel Solution Analysis Phase begins with the Materiel Development Decision review which is the formal entry point into the acquisition process. The lead DoD Component(s) prepare an AoA study plan to assess preliminary materiel solutions, identify key technologies, and estimate life-cycle costs. The Materiel Solution Analysis Phase ends when the AoA has been completed, materiel solution options for the capability need identified in the approved ICD have been recommended by the lead DoD Component conducting the AoA, and the phase-specific entrance criteria for the initial review milestone have been satisfied. (DODI 5000.02)

Materiel Solution Analysis Phase

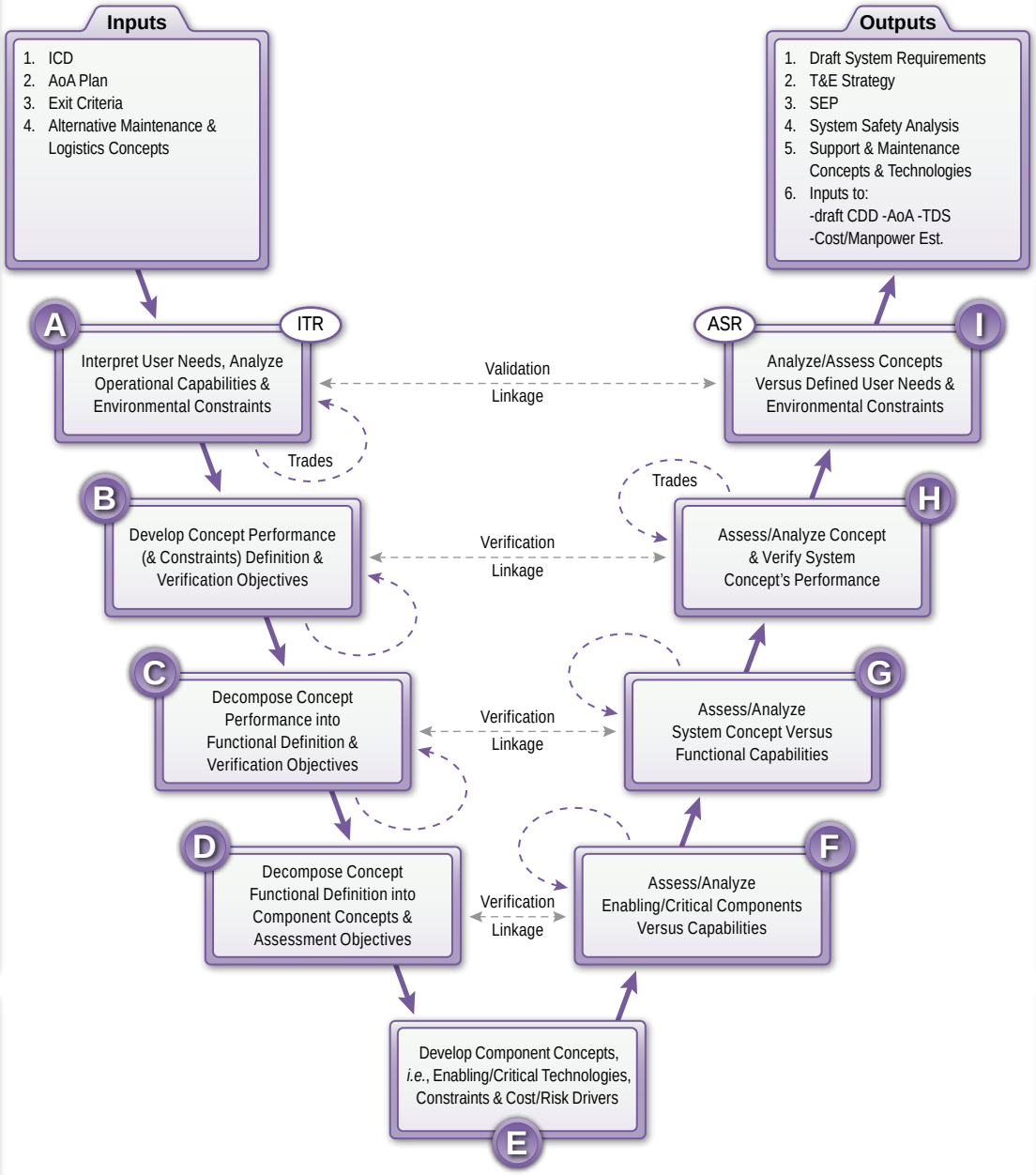


Materiel Solution Analysis Phase

Human Systems Integration

Activities for Each Input:

1.0 Review available Concept of Operations (CONOPS) and other available data
1.1 Select and review Baseline Comparison System(s) (BCS) documentation
1.2 Assess potential HSI domain effects
1.3 Ensure human constraints are included
1.4 Ensure domain points of contact (POCs) are identifed
2.0 Set HSI conditions and constraints for consideration in Analysis of Alternatives (AoA)
2.1 Collect domain inputs for each alternative
2.2 Defne trade space and risk associated with each of the domains
3.0 Identify, compile, and track domain exit criteria
4.0 Set HSI conditions and constraints for consideration in concepts
4.1 Collect domain inputs for each concept
4.2 Defne trade space and risk associated with each domain and provide inputs for each concept



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Collect domain requirements inputs
1.1 Ensure draft system requirements include human constraints
2.0 Determine which HSI domains can be tested
2.1 Provide domain inputs as applicable
3.0 Write draft HSI Plan
4.0 Ensure each domain reviews the Environment, Safety and Occupational Health (ESOH) hazard and risk analysis for each system [*e.g.*, the Preliminary Hazard List (PHL)]
4.1 Collect domain impacts and costs
4.2 Provide domain trade-off impacts
5.0 Summarize domain trade-off inputs
5.1 Provide consolidated domain inputs
6.0 Provide HSI and domain inputs as applicable

References:

- DODI 5000.02 & DODD 5000.01
- Defense Acquisition Guidebook (DAG)
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

Tools:

- CATIA
- HSI Requirements Guide
- IMPRINT

Materiel Solution Analysis: Human Systems Integration

A

- Assess and identify applicable HSI limitations pertaining to environmental issues such as system threats, usage environment, support environment, doctrine, and operational concepts
- Assess and identify applicable HSI limitations pertaining to resources such as the industrial base, notional available development, operation and support budgets, and required date for system fielding
- Assess and identify applicable HSI limitations on the technology base to be used for concept maturation
- Review applicable HSI limitations in statutory and regulatory documents such as the Federal Acquisition Regulation, the DoD 5000-series, CJCSM/I guidance, *etc.*
- Ensure all HSI drivers of the concept definition are completely captured and managed as an integral human-centered system

B

- Analyze and assess trade space and HSI risks for each alternative concept
- Define and relate human performance to capability needs and draft CONOPS
- Define test requirements needed to evaluate the ability of the matured system concept(s) to meet requirements of verification planning
- Assess and document derived HSI requirements at the system performance level

C

- Translate concept-level HSI criteria (*e.g.,* applicable HSI impacts, human performance limitations, domain-specifc risks, tactical system, support system, training system, *etc.*) into functional requirements
- Analyze and assess trade space and HSI risks against desired functional performance in accordance with draft CONOPS
- Enable verifcation planning for test and evaluation of matured concept functionality as defned in system function allocation

D

- Analyze allocation of concept functions into component concepts and assessment objectives OR apply identifed HSI constraints to analyze and defne concept component design requirements
- Test and evaluate HSI component-level requirements through verifcation planning

E

- Ensure that HSI is adequately addressed in analyses, modeling and simulation, demonstrations, *etc.*
- Review historical information (*e.g.,* successes, mishaps, lessons learned, poor human performance, *etc.*)

F

- Assess HSI impacts when rating component concept alternatives
- Review results of hardware and software modeling, simulations, demonstrations, and prototypes to verify the satisfaction of component-level HSI requirements

G

- Ensure that HSI attributes are integrated to support overall capability
- Assess HSI functional-level impacts of rating concept alternatives
- Review results of hardware and software modeling, simulations, demonstrations, and prototypes to verify that functional-level HSI requirements have been satisfed

H

- Assess each system concept against identifed HSI criteria and requirements
- Document critical HSI risks, mitigations, and potential trade-offs for each concept alternative
- Rate concept alternatives at this level to identify critical HSI risks and mitigation control measures

I

- Ensure that HSI considerations are included in the identifcation of advantages/ disadvantages for each approach
- Ensure that enabling technologies address HSI considerations

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ITR

- Review Cost Analysis Requirements Description (CARD)-like documents to confrm that HSI has been included in the system overview, risk and system operation concept
- Verify that HSI inputs are included throughout the program's cost estimate
- Verify that HSI domain requirements are included and presented in suffcient detail to support a valid program cost estimate
- Provide HSI inputs to refect the chosen materiel solution approach
- Provide HSI assumptions, risks, and cost drivers

ASR

- Review AoA and evaluate multiple alternatives for the system
- Verify that system requirements are consistent with user needs and applicable HSI domain standards
- Provide HSI inputs and risks for alternative materiel solutions that have been identifed

Trades

- Participate in AoA to ensure that HSI considerations have been addressed in the assessment of advantages and disadvantages
- Participate in trade studies to identify potential HSI hazards and risks, to ensure that HSI criteria are included in this phase

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

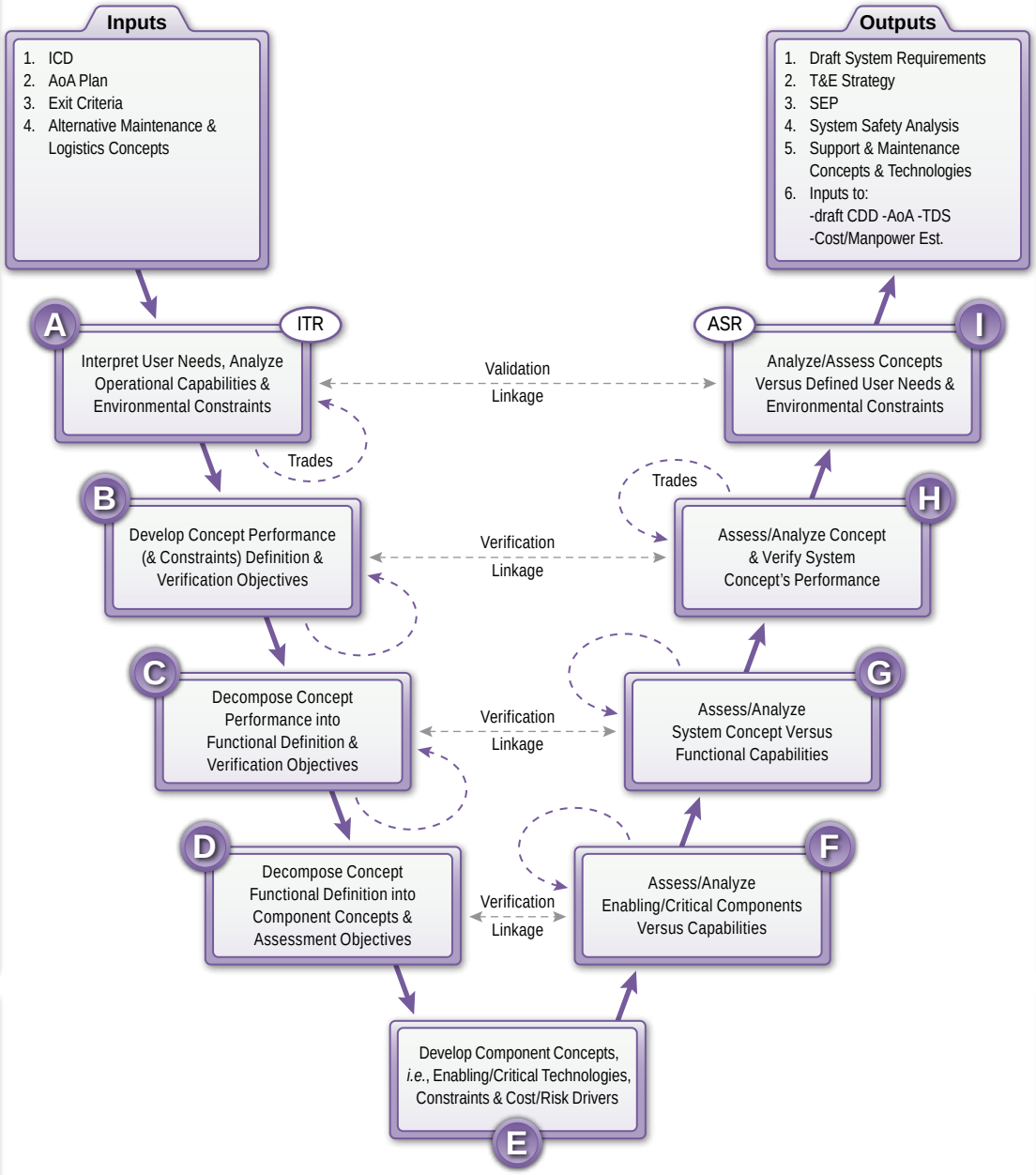
Manpower

Activities for Each Input:

1.0 Review all available data (CONOPS, ICD, requirements documents, *etc.*)
1.1 Identify a BCS for comparative analysis
2.0 Ensure AoA plan includes manpower tasks
2.1 Review force structure baseline if applicable
2.2 Gather historical manpower data for legacy system(s) for comparative manpower analysis
3.0 Identify, compile and track manpower exit criteria
3.1 Ensure notional manpower concepts are included in CONOPS and Logistics Concepts
4.0 Examine the alternative maintenance and logistics concepts
4.1 Begin building task lists for the various alternatives
4.2 Estimate manpower costs for the alternatives including 2-level and 3-level maintenance and contractor logistics support

References:

- CJCSI 3170.01
- AFI 38-201
- AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Review system requirements for impacts to manpower, especially force structure, number of operating locations, and maintenance concepts
2.0 Refne the initial task list based on test operations tasks
2.1 Identify potential manpower drivers in the T&E strategy
3.0 Provide preliminary manpower costs and issues to SEP
4.0 Review safety analyses for potential manpower drivers
5.0 Assess the concepts and technologies
5.1 Develop/Refne task lists for the concepts
5.2 Estimate manpower costs for the alternatives
6.0 Develop the initial manpower Program Objective Memorandum (POM) estimate
6.1 Prepare initial MER
6.2 Provide a manpower input to the program acquisition strategy and LCMP

Tools:

- LCOM, CHRIS, MPES
- Job, Task, Function Workload Analysis
- TDFA, TSSA
- Manpower Typicals
- HSI Requirements Guide

Materiel Solution Analysis: Manpower

A

- Collect preliminary CONOPS data on the new system, *i.e.,* system requirements, concepts, functions, performance goals, performance standards, equipment, operational environment, force structure, and sustainment concept

B

- Identify a BCS and/or system components for comparative analysis
- Identify potential manpower drivers in the ICD *e.g.,* 24 hour operations, 2-man safety practices, *etc.*
- Determine manpower objectives, constraints, performance criteria, trade-offs, risks, and cost-drivers as inputs to major program documentation

C

- Collect and calculate manpower requirements from the BCS and conduct a rough comparison with the new system to develop an initial manpower estimate
- Identify functional-level differences between the baseline system and alternatives
- Compare known parameters of the BCS with functional requirements of the new system(s)

D

- Identify component-level differences between the baseline system and alternatives

E

- Begin building and refning task lists for the various alternatives at the job/task level for tasks associated with operating, maintaining, and supporting the system
- Estimate manpower costs for the alternatives at the job/task level for tasks associated with operating, maintaining, and supporting the system

F

- Estimate manpower resource changes required for the new system (operation, maintenance, support) based on component-level differences between the baseline system and alternative systems
- Identify manpower requirements for the training pipeline
- Assess and document risk of Air Force (AF) inability to meet manpower requirements at the component level

G

- Estimate manpower resource changes required for alternatives based on differences with the baseline system at the functional level
- Assess and document risk of AF inability to meet manpower requirements at the functional level
- Assess manpower impacts of planned training methods for functional-level tasks

H

- Estimate manpower resource changes required for alternatives based on differences with the baseline system at the system level
- Continue populating cost and manpower estimates at the system level
- Assess and document risk of AF inability to meet manpower requirements at the system level
- Review modeling, simulations, and analyses to validate manpower inputs for operations and sustainment
- Assess manpower impacts of planned training methods for system-level operations and tasks

I

- Complete preliminary manpower cost estimates for all alternative systems
- Ensure all risks of AF inability to meet manpower requirements at the planned operational readiness level and operations tempo (OPSTEMPO) are documented, and refected in the program cost estimate and related program documents
- Update system-level requirements as necessary to record any new or revised training manpower requirements
- Review program schedule and POM to ensure manpower is funded in sync with operations and sustainment

---

ITR

- Review initial technical confguration and identify any manpower issues
- Ensure suffcient detail is provided to support a valid cost estimate
- Provide manpower inputs to refect the chosen materiel solution approach
- Provide manpower assumptions, risks, and cost drivers

ASR

- Evaluate manpower costs for each alternative system and provide strategy options for reducing manpower costs if/as appropriate
- Ensure the manpower requirements agree with user needs and expectations
- Provide manpower inputs and risks for alternative materiel solutions that have been identifed

Trades

- Participate in trade studies to evaluate options against manpower costs throughout this phase to ensure manpower concerns are addressed

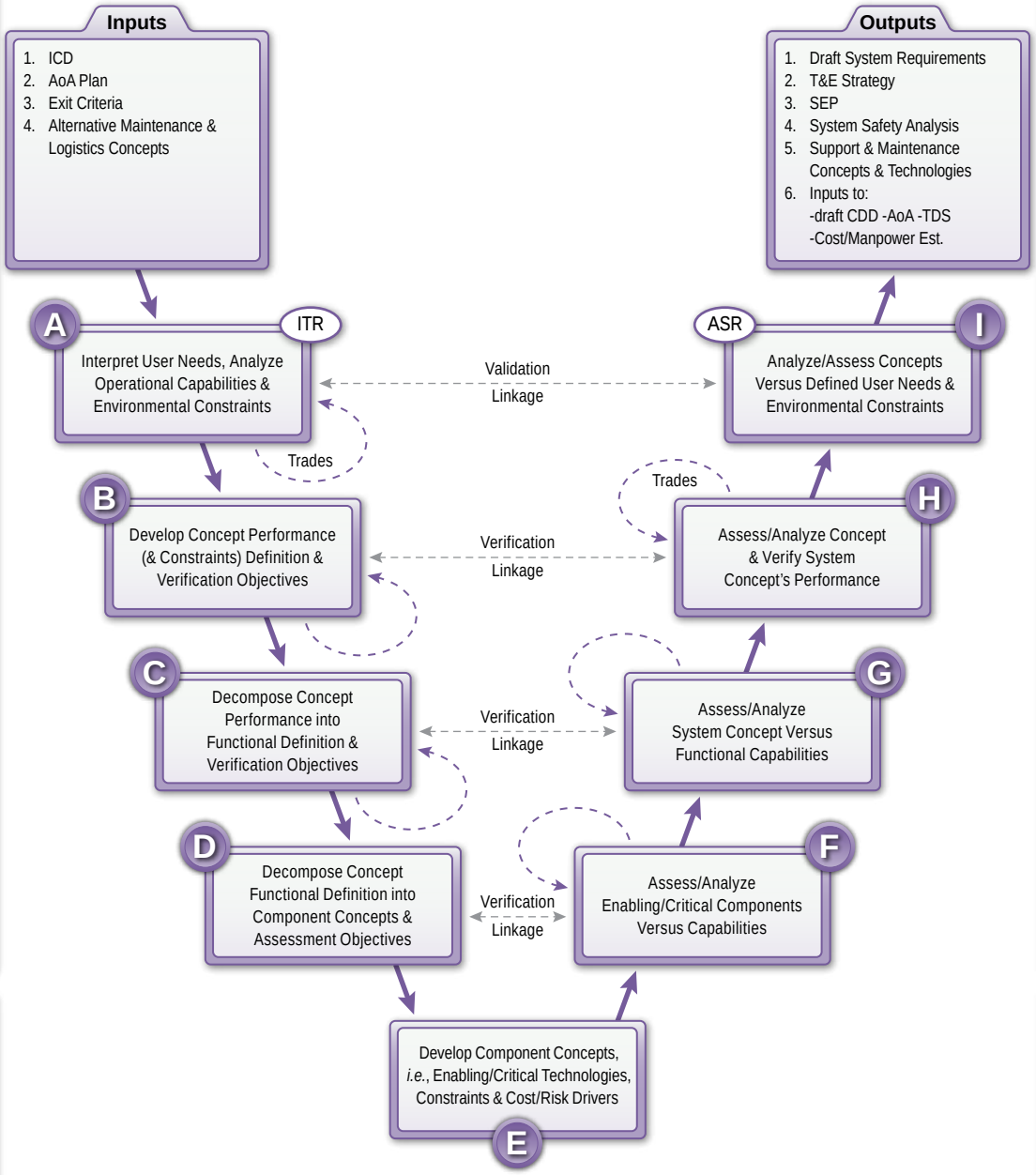
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

Personnel

Activities for Each Input:

1.0 Review all available data (CONOPS, ICD, requirements documents, *etc.*)
1.1 Identify a BCS for comparative analysis
1.2 Initiate personnel requirements assessment
2.0 Begin developing a target audience description
2.1 Provide key skill set necessities to support system for AoA inclusion
3.0 Provide exit criteria including BCS and personnel integration strategy for SEP
3.1 Ensure that notional personnel concepts are included in the CONOPS and Logistics Concepts
4.0 Assess personnel drivers
4.1 Look for problem areas and consider trade-offs
4.2 Provide a list of issues/risks



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.1 Provide personnel objectives, constraints, and/or performance criteria
1.2 Identify potential new Air Force Specialty Codes (AFSCs) or Special Experience Identifers (SEIs) required to operate and support the new system
2.0 Review the initial task list based on test operations tasks
3.0 Identify responsibilities for personnel integration into SE
4.0 Review the SSA for potential personnel impacts
5.0 Assess the support and maintenance concepts and technologies
6.0 Provide personnel inputs as needed
6.1 Review and provide input to LCMP

References:

- CJCSI 3170.01
- AFI 63-101
- AFPD 36-14
- AFPD 36-21 & AFPD 36-22
- AFI 36-3802 & AFI 36-2623
- AFI 36-2305
- AFI 36-2101 & AFI 36-2110

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect
- HSI Requirements Guide

Materiel Solution Analysis: Personnel

A

- Review aptitude constraint effects on the system functionality
- Identify potential needs for a new specialty code and/or skill set
- Recognize applicable personnel criteria and asset requirements
- Review historical information (*e.g.,* successes, mishaps, lessons-learned, poor human performance, *etc.*)

B

- Identify a BCS and/or components for comparative analysis
- Determine personnel objectives, constraints, performance criteria, trade-offs, risks, and cost-drivers as inputs to major program documentation

C

- Begin developing a Target Audience Description (TAD) based on the functional definition and the operations and support concept
- Compare known parameters of the BCS with functional requirements of the new system(s)

D

- Compare known parameters of the BCS with functional requirements of the new system(s)

E

- Estimate personnel necessities required for the new system (operation, maintenance, support)
- Ensure personnel requirements are adequately addressed in analyses, modeling and simulation, demonstrations, *etc.*

F

- Assess personnel requirements against critical component capabilities
- Document risks where AF personnel (military and civilian) may be unable to support system components without process and/or product modification
- Begin building task lists for the various alternatives for tasks associated with operating, maintaining, and supporting the system

G

- Associate tasks to AFSCs and assess initial training personnel requirements
- Assess personnel requirements against functional capabilities
- Document risks where AF personnel may be unable to support system functions without process and/or product modification
- Assess each system function against identified personnel criteria and requirements

H

- Evaluate if the overall system concept will meet performance capability requirements within identified personnel constraints
- Document risks of AF personnel ability to support the system without process and/or product change

I

- Evaluate if the overall system concept will meet performance capability requirements within identified personnel constraints
- Document risks of AF personnel ability to support the system without process and/or product change
- Refine the initial task lists for tasks associated with operating, maintaining, and supporting the system, including identification of all AFSCs and civilian series

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ITR

- Review initial technical configuration and identify any personnel issues
- Ensure technical baseline is detailed enough to support a valid cost estimate
- Provide personnel inputs to reflect the chosen materiel solution approach
- Provide personnel assumptions, risks, and cost drivers

ASR

- Evaluate personnel costs for each alternative system and provide strategy options for reducing personnel costs if/as appropriate
- Ensure personnel requirements agree with user needs and expectations with respect to operations and maintenance concept
- Provide personnel inputs and risks for alternative materiel solutions that have been identified

Trades

- Participate in trade studies to evaluate options against identified personnel criteria throughout this phase to ensure personnel concerns are addressed

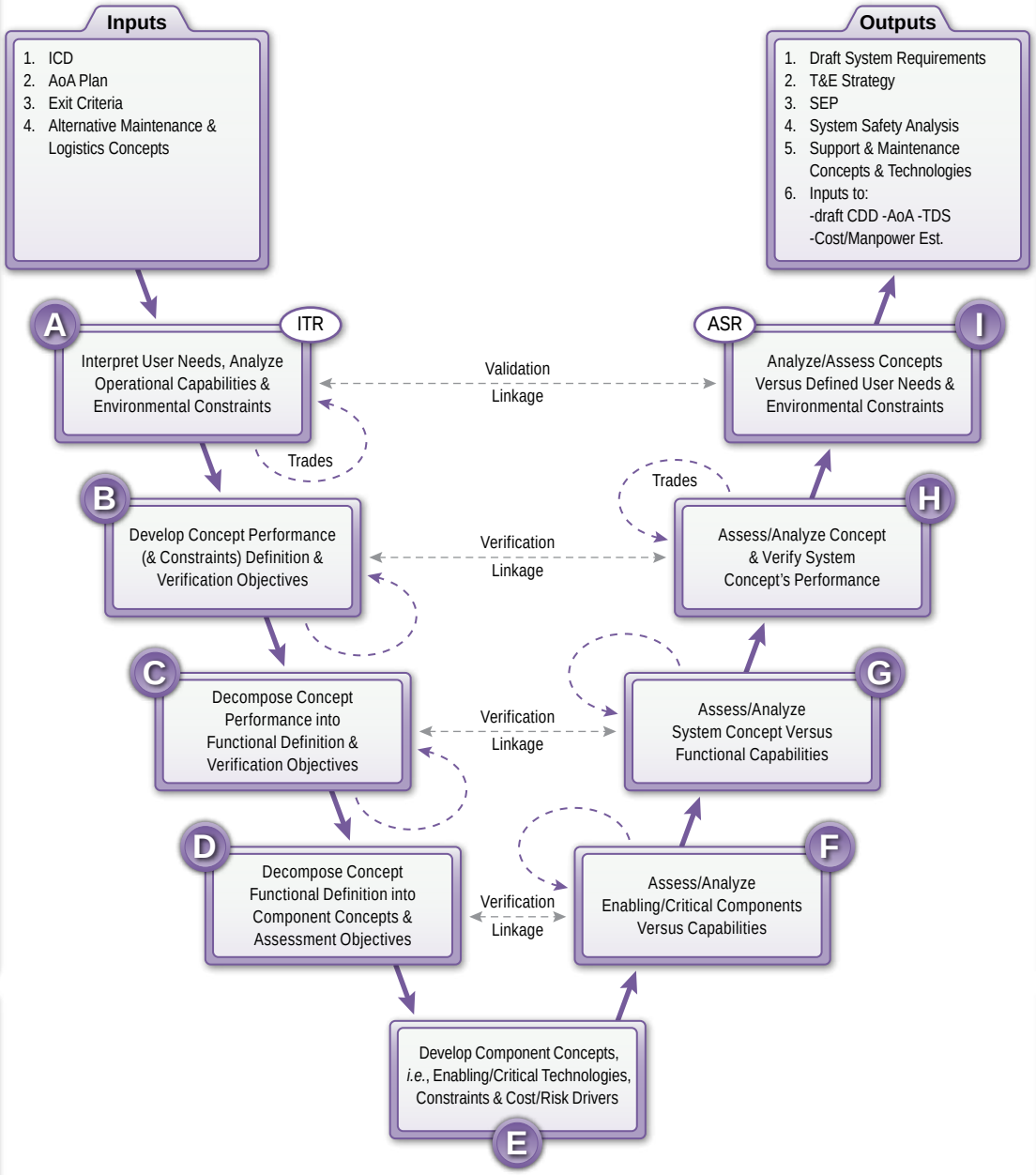
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

Training

Activities for Each Input:

1.0 Review all available data (CONOPS, ICD, requirements documents, *etc.*)
1.1 Establish a training planning team
1.2 Identify a BCS for comparative analysis
2.0 Identify training concepts to support multiple system concepts in support of the AoA
3.0 Provide training exit criteria if appropriate and feasible
4.0 Examine alternative concepts
4.1 Create task lists to support alternatives
4.2 Provide training inputs, as requested for 2- and 3-level maintenance and for contractor logistic support



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Identify training requirements (including training devices and courseware), constraints, and performance attributes for the system
1.1 Identify trainer/simulator requirements and any associated facility needs
2.0 Identify training drivers within the T&E Strategy
2.1 Ensure requirements for training system validation are included in the T&E Strategy
3.0 Identify responsibilities for training integration into SE
4.0 Review system safety analyses for potential training issues
5.0 Assess the support and maintenance concepts and technologies for training requirements
5.1 Ensure consistency between system training requirements and sustainment concepts
6.0 Initiate training analysis and provide training inputs as required
6.1 Review cost and manpower estimates for school house and training pipeline support
6.2 Review and provide inputs to the LCMP

References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3 & V6
- AFMAN 36-2234 & AFPD 36-22
- ISO/IEC 15288
- MIL-HDBK-29612A

Tools:

- HPAT
- ADVISOR
- AIM
- HSI Requirements Guide

Materiel Solution Analysis: Training

A

- Collect training data on comparable systems including operations training courses, maintenance courses, and schoolhouse throughput for all officers/enlisted/civilians associated with comparable systems

B

- Initiate training needs analysis for the system
- Begin analyzing and documenting training requirements to operate and support the new system

C

- Identify and document system functions or functional-level requirements not currently performed by comparable systems

D

- Identify and document components or component-level requirements not currently part of comparable systems

E

- Begin estimating necessary training resources for the new system to include trainers/simulators and any associated facilities
- Task career field managers to determine skill level (3-, 5-, 7-) training requirements and initial numbers
- Prepare a cost estimate structure to build up training cost estimates from the component level
- Document those resources and estimates in applicable program plans or reports

F

- Begin populating cost and manpower estimates at the component level for each system concept
- Assess and document risk of AF inability to meet training requirements at the component level
- Validate planned training methods for component-level tasks

G

- Continue populating cost and manpower estimates at the functional level for each system concept
- Assess and document risk of AF inability to meet training requirements at the functional level
- Validate planned training methods for functional-level tasks

H

- Continue populating cost and manpower estimates at the system level for each system concept
- Assess and document risk of AF inability to meet training requirements at the system level
- Validate planned training methods for system-level operations and tasks

I

- Complete cost estimates for all alternative systems
- Ensure all risks of AF inability to meet training requirements, at the planned operational readiness level and OPSTEMPO, are documented and reflected in the program cost estimate and related program documents
- Update system-level requirements as necessary to record any new or revised training requirements

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ITR

- Review initial technical configuration and identify any training issues
- Ensure technical baseline is detailed enough to support a valid cost estimate
- Provide training inputs to reflect the chosen materiel solution approach
- Provide training assumptions, risks, and cost drivers

ASR

- Evaluate training costs for each alternative system and provide strategy options for reducing training costs if/as appropriate
- Ensure set of requirements agrees with user needs and expectations with respect to operations and maintenance concept
- Provide training inputs and risks for alternative materiel solutions that have been identified

Trades

- Participate in trade studies to evaluate options against training costs throughout this phase to ensure training concerns are addressed

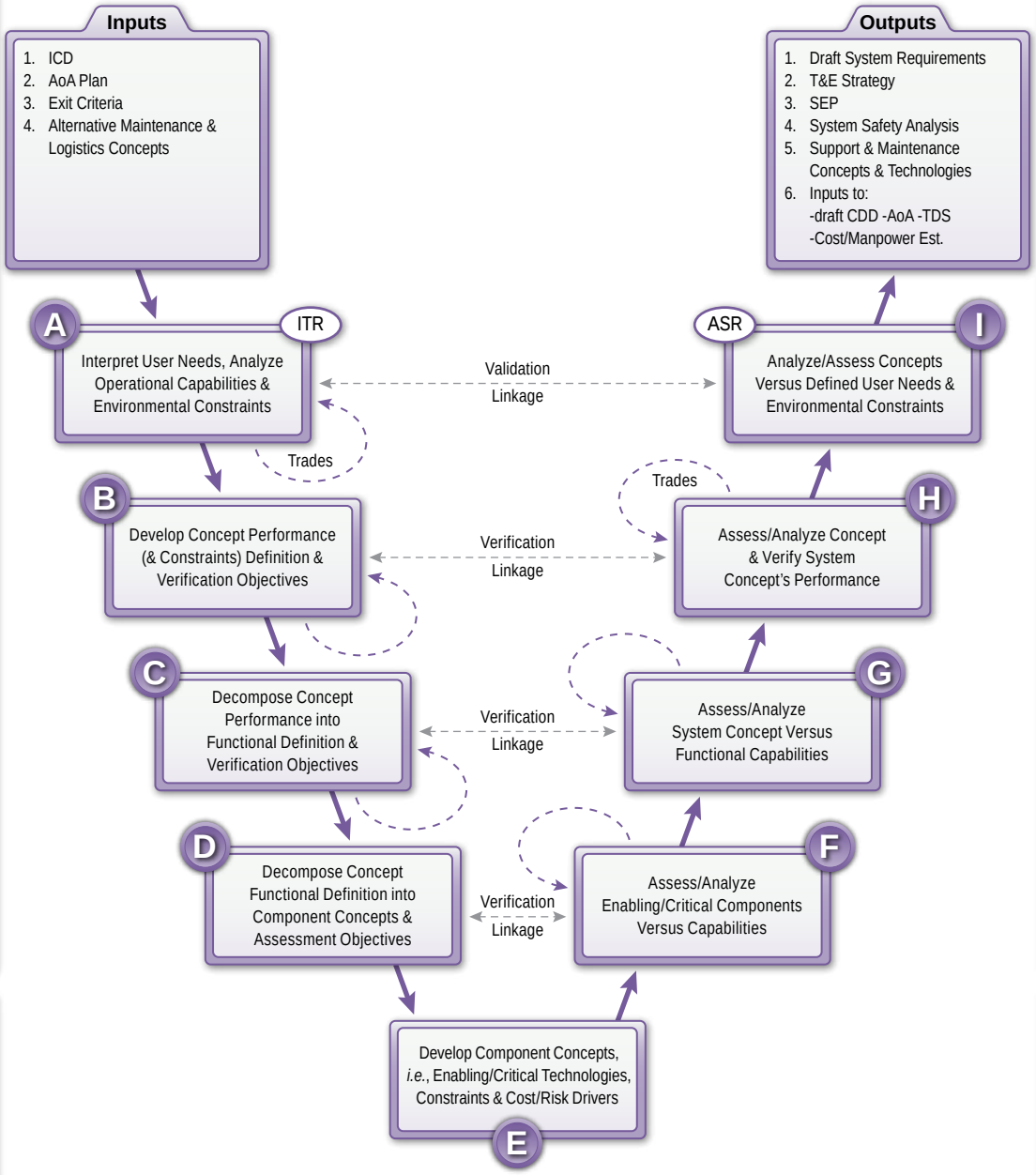
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

Human Factors Engineering

Activities for Each Input:

1.0 Identify HFE characteristics as part of capability definition
2.0 Develop alternatives with HFE considerations
2.1 Identify HFE constraints and issues
2.2 Identify HFE performance criteria objectives, trade-offs and risks
3.0 Provide exit criteria for preliminary HFE concern list
3.1 Include a strategy for integrating HFE into SE processes and SEP
3.2 Develop HFE exit criteria
3.3 Ensure notional HFE concepts are included in the CONOPS and Logistics Concept
4.0 Provide HFE inputs to supportability strategy
4.1 Identify HFE constraints and issues
4.2 Identify HFE performance criteria, objectives, trade-offs, and risks



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Identify HFE requirements, constraints and performance attributes for the system
1.1 Incorporate HFE requirements as applicable
1.2 Identify system requirements with human interface
2.0 Provide approach to HFE test and verification methodologies and approach towards HFE inclusion
2.1 Provide HFE inputs to the test plan
2.2 Initiate HFE planning
3.0 Participate in developing the strategy for integrating HFE considerations in to SE using MIL-STD-1472
3.1 Identify responsibilities for HFE integration into SE
4.0 Identify HFE considerations in support of manual/automated safety system testing
4.1 Identify HFE risk areas
5.0 Identify potential HFE operations and maintenance issues along with emerging HFE technologies and methods
5.1 Provide HFE inputs to maintenance strategy
6.0 Provide HFE inputs as required
6.1 Initiate HFE planning

References:

- AFI 63-101 & AFI 63-1201
- MIL-STD-1295A
- MIL-STD-1472 & MIL-STD-1478
- MIL-HDBK-46855

Tools:

- AVOSCET
- IMPRINT
- Micro Saint Sharp
- JACK
- IPME
- HSI Requirements Guide

Material Solution Analysis: Human Factors Engineering

A

- Assess and identify applicable HFE environment, support environment, doctrine, and operational concepts
- Use applicable technology base for concept maturation
- Ensure all HFE drivers of the concept defnition are fully captured & managed as an integral human centered system
- Collect lessons learned from other systems
- Identify HFE constraints and issues

B

- Assess each system concept (if available) against identifed HFE criteria & requirements
- Assess HFE risks for each alternative concept
- Ensure human performance requirements are well-defned and related to the capability needs
- Ensure verifcation planning defnes the test requirements needed to evaluate the ability of the matured system concept(s) to meet HFE requirements
- Participate in trade-off analyses

C

- Translate concept-level HFE criteria (*e.g.,* applicable HFE impacts, human performance limitations, domain specifc risks, tactical system, support system, training system, *etc.*) into functional requirements
- Assess HFE risks for each alternative concept
- Ensure verifcation planning enables T&E of the matured concept functionality
- Tailor key HFE issues to system-specifc needs

D

- Analyze, defne & mitigate concept design requirements for HFE constraints
- Initiate identifcation of component HSI constraints

E

- Initiate identifcation of component HFE constraints
- Ensure HFE is adequately addressed in analyses, modeling and simulation, demonstrations, *etc.*
- Review historical information (*e.g.,* successes, mishaps, lessons-learned, poor human performance, *etc.*)
- Collect lessons learned from other systems
- Begin estimating necessary HFE resources for the new system
- Prepare a cost estimate structure to build up HFE cost estimates from the component level
- Document those resources and estimates in applicable program plans or reports

F

- Identify HFE requirements against critical component capabilities
- Assess HFE impacts when rating concept alternatives

F *Cont.*

- Collect lessons learned from other systems
- Identify HFE constraints and issues
- Assess and document risk of AF inability to meet HFE requirements at the component level
- Validate planned HFE concepts for component-level tasks

G

- Ensure HFE attributes work together as an integral part of the overall capability
- Assess HFE impacts if rating concept alternatives
- Assess and document risk of AF inability to meet HFE requirements at the functional level
- Validate planned HFE concepts for functional-level tasks

H

- Evaluate the conceptual ability of the system to meet performance capability requirements within identifed HFE constraints
- Rate concept alternatives at this level to help identify critical HFE risks and mitigation control measures
- Assess and document risk of AF inability to meet HFE requirements at the system level
- Validate planned HFE concepts for system-level operations and tasks

I

- Ensure the preferred HFE approach for each system concept is refected
- Identify HFE risks and mitigation control measures if applicable
- Collect lessons learned from other systems
- Update trade-off analyses
- Ensure all risks of AF inability to meet HFE requirements, at the planned operational readiness level and OPSTEMPO, are documented and refected in the program cost estimate and related program documents
- Update system-level requirements, as necessary, to record any new or revised HFE requirements

ITR

- Ensure HFE issues are suffciently detailed to support a valid cost estimate
- Provide HFE inputs to refect the chosen materiel solution approach
- Provide HFE assumptions, risks, and cost drivers

ASR

- Ensure the set of HFE requirements meets user needs and expectations
- Provide HFE inputs and risks for alternative materiel solutions that have been identifed

Trades

- Ensure HFE considerations are addressed in trade studies, alternate solutions and proposed prototypes
- Analyze and assess the trade space and HFE risks for each alternative concept

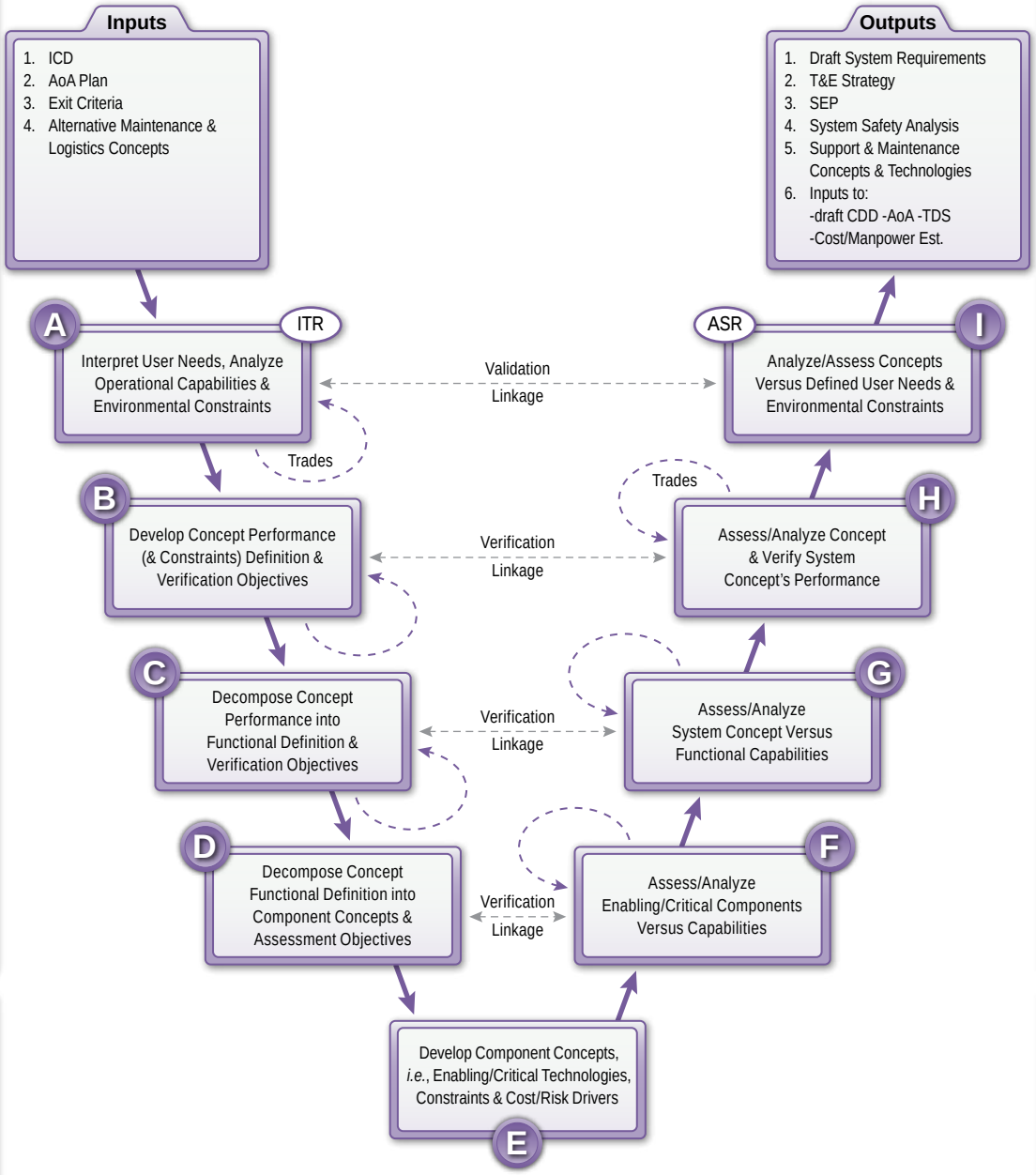
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

Survivability

Activities for Each Input:

1.0 Provide survivability (Sv) characteristics as part of the capability definition
1.1 Review CONOPS
2.0 Participate in AoA development with Sv considerations
2.1 Develop Parameter Assessment List (PAL) to consider each system concept
3.0 Provide exit criteria to include regulatory compliance support and a strategy for integrating Sv risk management into the SEP
4.0 Ensure adequate maintenance task detail is documented for each logistic concept



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Identify Sv requirements, constraints, and performance attributes for the system
1.1 Incorporate Sv requirements as applicable
2.0 Provide approach to Sv and verifcation
3.0 Participate in developing the strategy for integrating Sv risk management into SE
3.1 Identify responsibilities for Sv integration into SE
4.0 Ensure the PAL has been completed for each system concept
5.0 Identify potential Sv issues and identify emerging Sv technologies and hazards for each sustainment concept
6.0 Refne initial Sv planning and life cycle cost estimates
6.1 Ensure maintenance manpower planned for Sv sustainment is comparable to legacy systems
6.2 Ensure Sv risks are considered in the LCMP

References:

- DODD 5000.01 & DODI 5000.02
- AFPD 63-1/AFPD 20-1
- AFI 63-101
- AFI 63-1201
- AFI 90-901
- 10 USC 2366

Tools:

- PAL
- PAL-MATE
- HSI Requirements Guide
- BRAWLER

Materiel Solution Analysis: Survivability

A
- Identify applicable Sv criteria and requirements
- Provide Sv inputs to support ITR as required
- Define operational environment and assess applicability to elements of Sv

B
- Analyze and assess trade space and hazard risks for each alternative concept
- Identify systems-level requirements for Sv
- Determine verification methods for the requirements for this phase and future phases (if possible)
- Initiate PAL

C
- Translate concept-level Sv criteria (*e.g.,* fratricide, detectability, damage reduction, stress and fatigue) into functional requirements
- Identify applicable verification objectives
- Analyze and assess trade space and hazard risks against desired functional performance

D
- Initiate identification of component constraints

E
- Update PAL
- Initiate identification of component constraints
- Review historical information (*e.g.,* successes, mishaps, lessons-learned) from similar or legacy systems

F
- Identify Sv requirements against critical component capabilities
- Evaluate component test and analysis results against identified component-level constraints and requirements
- Assess and document risk of AF inability to meet Sv requirements at the component level

G
- Evaluate Sv functional requirements for the system concept based upon component test/analysis results
- Assess and document risk of AF inability to meet training Sv requirements at the functional level

H
- Evaluate the conceptual ability of the system to meet performance capability requirements within identified Sv constraints
- Assess and document risk of AF inability to meet Sv requirements at the system level

I
- Finalize PAL for each system concept
- Assess risk for each approach for system concept and CONOPS based on ability to meet Sv requirements
- Ensure all risks of AF inability to meet Sv requirements, at the planned operational readiness level and OPSTEMPO, are documented and reflected in the program cost estimate and related program documents

---

ITR
- Identify applicable Sv criteria for the system
- Ensure concepts have sufficient detail with regard to Sv requirements to support a valid program cost estimate
- Provide Sv inputs to refect the chosen materiel solution approach
- Provide Sv assumptions, risks, and cost drivers

ASR
- Prepare results of PAL for each alternative and recommend Sv level of effort required for the Technology Development phase
- Ensure requirements are consistent with user needs and applicable Sv domain standards
- Provide Sv inputs and risks for alternative materiel solutions that have been identified

Trades
- Participate in trade studies to identify potential top-level hazards and ensure Sv criteria are included in the trade studies throughout the Materiel Solution Analysis phase

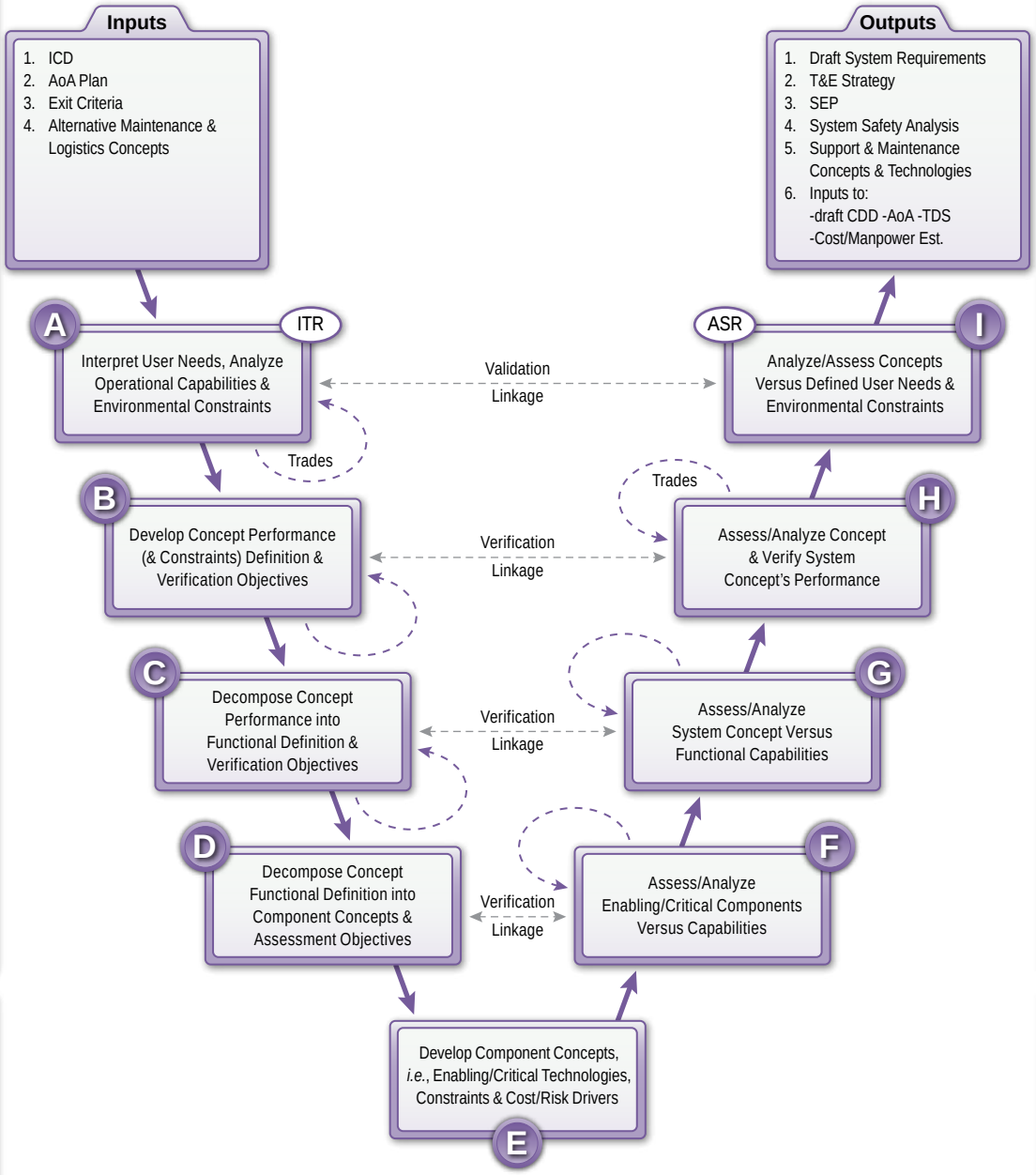
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

Environment

Activities for Each Input:

1.0 Provide environment characteristics as part of capability definition especially with regard to operations and at all levels of maintenance
1.1 Identify environment considerations in ICD
1.2 Identify environment constraints and issues
2.0 Participate in AoA development
3.0 Provide exit criteria for ESOH hazard and risk analysis
3.1 Develop exit criteria for integrating environment risk
4.0 Identify and provide sustainment related data required to accomplish environment assessment



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Provide ESOH hazard and risk analysis and environment criteria
1.1 Identify environment requirements, constraints, and performance attributes for the system (*e.g.*, MIL-STD-810G)
2.0 Provide environment hazard risk mitigation test and verification methodologies, and approach towards obtaining environment risk acceptance
3.0 Participate in development of strategy for integrating environment hazard risk management into SEP using MIL-STD-882D
3.1 Ensure responsibilities for complying with environment requirements are integrated into SEP
3.2 Provide approach to environment planning and the NEPA/EO 12114 compliance schedule
4.0 Identify potential environment operations and maintenance issues, and identify emerging environment technologies and hazards
5.0 Ensure ESOH hazard and risk analysis has been completed for each system concept
6.0 Provide environment inputs to requirements documents
6.1 Review and provide inputs to LCMP
6.2 Ensure environment factors are incorporated into cost estimate

References:

- NEPA/EO 12114
- DODI 4715.x series
- MIL-STD-810 series
- MIL-STD-882D & MIL-STD-1425A
- MIL-STD-1472 & MIL-STD-1474D
- AFI 32-7086
- AFI 63-1201 & AFI 90-901

Tools:

- Environmental Hierarchy
- Mishap Risk Assessment
- PESHE Checklist
- ESOH Programmatic Risk Assessment Toolset
- HSI Requirements Guide

Materiel Solution Analysis: Environment

A

- Review System Threat Assessment (STA) if available
- Identify applicable environment criteria and asset requirements (resource, technology, statutory and regulatory)
- Assess MIL-STD-810G to identify environment test conditions
- Identify operating and maintenance locations and proposed force structure if possible (for example, for a one-for-one system replacement)
- Initiate ESOH hazard and risk analysis (*e.g.,* PHL)
- Review historical information (*e.g.,* successes, mishaps, lessons-learned) from similar or related legacy systems

B

- Assess system level to identify/document probable environment constraints in operating and maintaining the system
- Review historical information (*e.g.,* successes, mishaps, lessons-learned) from similar or related legacy systems

C

- Translate concept-level environment criteria (*e.g.,* radiation, acoustics, induced health hazards) into functional requirements
- Review historical information (*e.g.,* successes, mishaps, lessons-learned) from similar or related legacy systems

D

- Identify environment requirements against critical component capabilities
- Analyze, define, and identify options to mitigate the identified environment constraints
- Review historical information (*e.g.,* successes, mishaps, lessons-learned) from similar or related legacy systems

E

- Update ESOH hazard and risk analysis (*e.g.,* PHL)
- Initiate identification of component constraints
- Recommend input into projected system attrition rates

F

- Evaluate component analysis and test results against identified component and system level constraints
- Assess and document risk of AF inability to meet environment requirements at the component level

G

- Evaluate fulfillment of environment functional requirements for the conceptual system based upon subsystem component test/analysis results
- Assess and document risk of AF inability to meet environment requirements at the functional level

H

- Evaluate conceptual system's ability to meet performance capability requirements within identified environment constraints
- Assess and document risk of AF inability to meet environment requirements at the system level

I

- Finalize ESOH hazard and risk analysis (*e.g.,* PHL) for each system concept
- Identify and characterize environment risks of each system concept
- Ensure all risks of AF inability to meet environment requirements, at the planned operational readiness level and OPSTEMPO, are documented and reflected in the program cost estimate and related program documents
- Update system-level requirements, as necessary, to record any new or revised environment requirements

---

ITR

- Identify applicable environment criteria for system
- Ensure concept has sufficient detail with regard to mitigation to support valid cost and schedule estimate
- Provide environment inputs to reflect the chosen materiel solution approach
- Provide environment assumptions, risks, and cost drivers

ASR

- Prepare results of ESOH hazard and risk analysis (*e.g.,* PHL) for each alternative and recommend level of effort required for the Technology Development phase
- Ensure requirements are consistent with user needs and comply with statutory and regulatory guidance
- Provide environment inputs and risks for alternative materiel solutions that have been identified

Trades

- Participate in trade studies to identify potential top-level hazards and ensure environment criteria are included in the trade studies throughout this phase

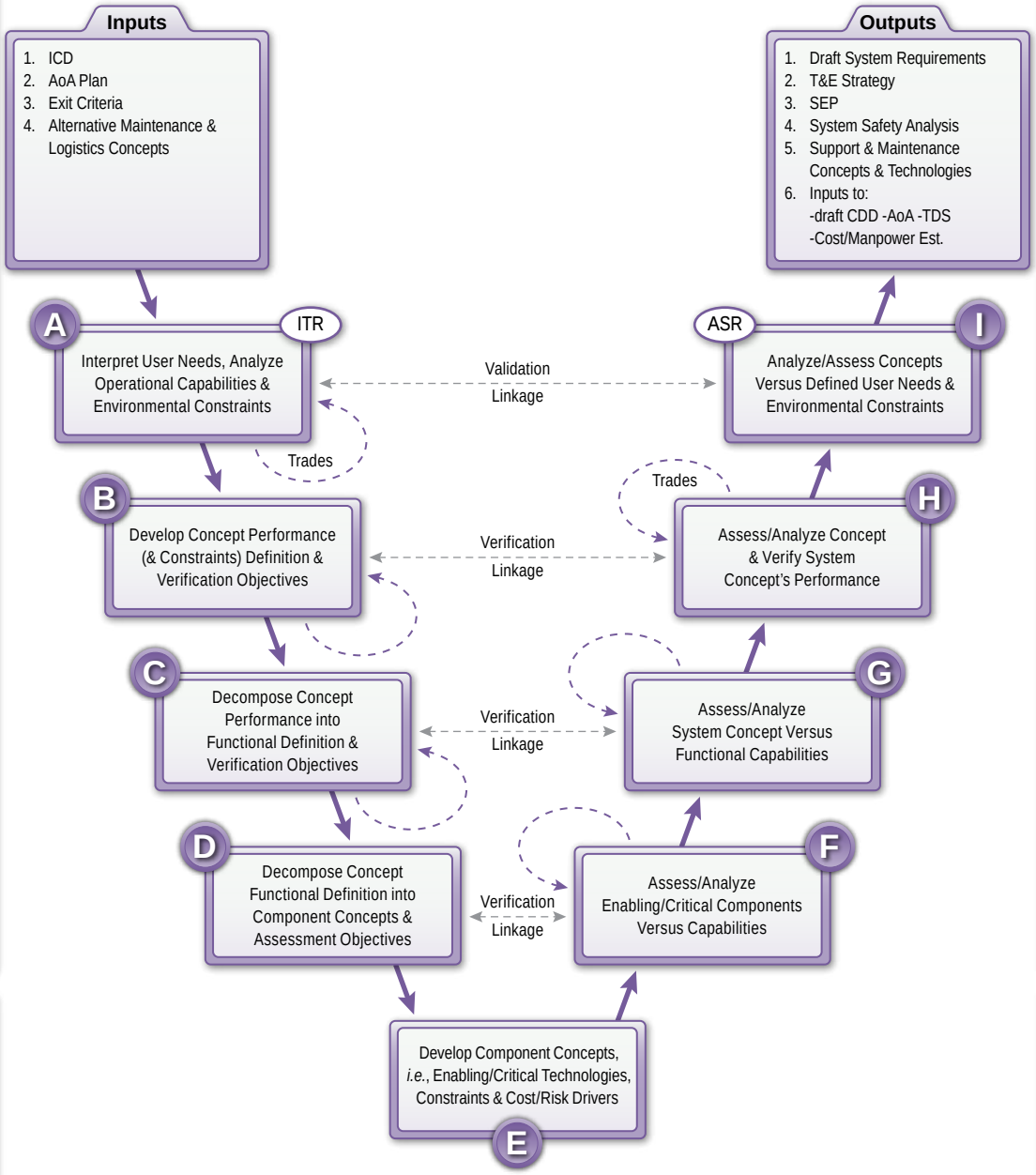
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

Safety

Activities for Each Input:

1.0 Review CONOPS for safety inputs
1.1 Provide safety characteristics as part of capability definition
2.0 Participate in AoA development
2.1 Ensure safety concerns are addressed in alternative options
3.0 Develop safety specifc exit criteria for ESOH hazard and risk analysis (*e.g.*, PHL)
3.1 Defne a safety risk management strategy in the SE process and SEP
4.0 Review alternative maintenance and logistics concepts for safety considerations
4.1 Utilize lessons learned from the mishaps of similar systems while considering alternatives



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Provide ESOH hazard and risk (*e.g.*, PHL) criteria
1.1 Identify safety requirements and performance attributes for system specifcations
2.0 Provide hazard risk mitigation test and verifcation methodologies
2.1 Develop an approach for obtaining safety release and risk mitigation acceptance
2.2 Provide safety plans for testing
3.0 Participate in developing and integrating hazard risk management strategies into SEP
3.1 Identify responsibilities for system safety integration
4.0 Update or modify the ESOH hazard and risk analysis (*e.g.*, PHL) for each system concept
5.0 Identify potential operational and maintenance concerns
5.1 Identify emerging technologies that will enhance safety and reduce system hazards
5.2 Incorporate safety and risk management strategies into the LCMP
6.0 Ensure mishap prevention and safety requirements are included in all acquisition documents and processes

References:

- AFOSH Standards
- MIL-STD-882D & MIL-STD-1425A
- DoD System Safety Handbook
- AFI 63-101 & AFI 63-1201
- AFI 90-901
- DAG
- AFI 91 Series

Tools:

- HMIRS
- ESOH Programmatic Risk Assessment Toolset
- ATB Model
- HSI Requirements Guide
- HFACS, HFIX

Materiel Solution Analysis: Safety

A

- Provide safety inputs to support ITR
- Assess and identify safety opportunities
- Identify resource, technology, and regulatory safety criteria
- Review STA if available for safety opportunities
- Ensure the concept definition safety drivers are captured and managed
- Review historical mishap prevention and safety information (successes, mishaps, lessons learned, DRs)

B

- Assess safety design parameters for each system concept
- Analyze and assess trade space and hazard risks for each alternative concept
- Define testing requirements to validate and verify safety design requirements
- Review historical mishap prevention and safety information (successes, mishaps, lessons learned, DRs)

C

- Translate concept-level safety design criteria into functional requirements
- Analyze and assess trade space and hazard risks for each desired functional performance objective
- Review historical mishap prevention and safety information (successes, mishaps, lessons learned, DRs)

D

- Develop ESOH hazard and risk analysis (*e.g.,* PHL)
- Identify component system safety and hazard reduction opportunities
- Identify critical component system safety requirements
- Review historical mishap prevention and safety information (successes, mishaps, lessons learned, DRs)

E

- Identify safety parameters that support concept decisions and technology selection considerations
- Review historical mishap prevention and safety information (successes, mishaps, lessons learned, DRs)

F

- Assess mishap prevention and design safety when rating concept alternatives at the component level
- Assess trade space decisions associated with component and capability factors
- Assess and document risk of AF inability to meet safety requirements at the component level

G

- Evaluate safety functional capabilities for each system concept based on component analysis and test results
- Assess safety functionality during system concept analysis
- Assess and document risk of AF inability to meet safety requirements at the functional level

H

- Evaluate the conceptual system's overall ability to meet performance capabilities while incorporating safety parameters
- Identify critical safety hazard risks and mitigation control measures for rating concept alternatives
- Assess and document risk of AF inability to meet safety requirements at the system level

I

- Identify the preferred safety design parameters that will meet user performance capabilities
- Identify mitigation control measures and residual risks for each system concept decision
- Finalize ESOH hazard and risk analysis (*e.g.,* PHL) for each system concept
- Ensure any risks of AF inability to meet safety requirements, at the planned operational readiness level and OPSTEMPO, are documented and reflected in the program cost estimate and related program documents
- Update system-level requirements, as necessary, to record any new or revised safety requirements

---

ITR

- Identify applicable safety criteria
- Ensure concept has sufficient detail with respect to risk mitigation to support valid cost estimates
- Provide safety inputs to reflect the chosen materiel solution approach
- Provide safety assumptions, risks, and cost drivers

ASR

- Prepare results of ESOH hazard and risk analysis for each alternative and recommend level of effort required for the Technology Development Phase
- Ensure safety design parameters support user capability requirements
- Provide safety inputs and risks for alternative materiel solutions that have been identified

Trades

- Participate in trade studies to ensure safety criteria are addressed and identify potential top-level hazards throughout the Materiel Solution Phase.

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

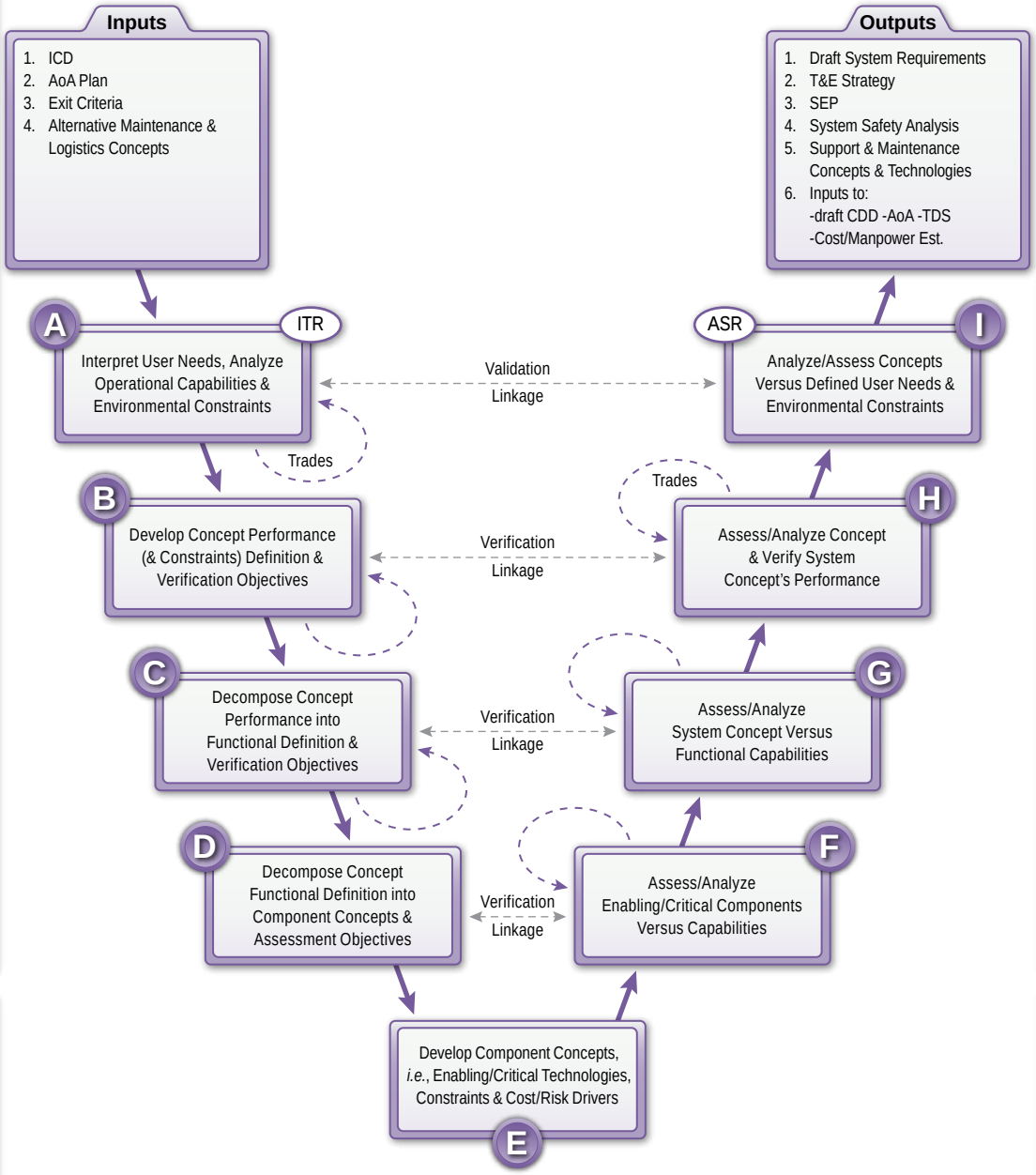
Occupational Health

Activities for Each Input:

1.0 Review CONOPS for OH inputs
1.1 Identify and document likely OH hazard characteristics as part of the capability definition
2.0 Participate in AoA development with key OH implications
2.1 Review all alternatives for OH implications and hazard risks
2.2 Ensure sufficient OH support is available for AoA
3.0 Develop OH specific exit criteria for ESOH hazard and risk analysis (*e.g.*, PHL)
3.1 Integrate strategy for health hazard management into the SE processes and SEP
4.0 Provide OH inputs for alternative maintenance and logistics solutions

References:

- DODD 5000.01 & DODI 5000.02
- MIL-STD-882D
- DODI 6055.05
- AFI 32-7086
- AFI 63-1201 & AFI 63-101
- AFPD 90-8 & AFI 90-901



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Provide ESOH hazard and risk analysis (*e.g.*, PHL) criteria
1.1 Identify OH requirements and constraints for the system specifications
2.0 Provide hazard risk mitigation test and verification methodologies
2.1 Develop risk acceptance approach for testing
3.0 Assist in strategy development for OH risk management and integration of OH into SE
4.0 Ensure completion of hazard analysis (*e.g.*, PHL) for each system concept
5.0 Identify potential OH operational and maintenance concerns
5.1 Identify emerging technologies and hazards
6.0 Ensure manpower estimates reflect mitigation of OH issues
6.1 Provide OH inputs for all documents and processes including LCMP
6.2 Ensure OH factors are incorporated into cost estimate

Tools:

- HMIRS
- BEE
- HSI Requirements Guide

Material Solution Analysis: Occupational Health

A

- Provide OH inputs to support ITR as required
- Assess and identify applicable OH limitations and constraints
- Identify resource, technology, and regulatory health hazard criteria
- Review STA if available
- Ensure all OH drivers of the concept definition are completely captured and managed as integral to human-centered systems
- Evaluate any legacy system/materials with similar function/mission

B

- Assess each system concept against identified OH criteria and requirements
- Analyze and assess trade space and hazard risks for each alternative concept
- Define verification planning and test requirements needed to evaluate the ability of the matured system concepts to meet requirements

C

- Translate concept level OH criteria into functional requirements
- Analyze and assess trade space and hazard risks against desired functional performance
- Evaluate verification planning to ensure effective T&E of matured concept

D

- Analyze, define, and mitigate any concept design requirements with identified OH constraints
- Initiate ESOH hazard and risk analysis (*e.g.,* PHL)
- Initiate identification of OH component constraints
- Identify OH requirements against critical component capabilities

E

- Address health hazards in analyses, modeling and simulation, demonstrations, *etc.*
- Review historical information (*i.e.,* legacy system) for lessons learned

F

- Assess OH and hazard impacts when rating concept alternatives
- Assess and document risk of AF inability to meet OH requirements at the component level
- Validate planned OH methods for component-level tasks

G

- Evaluate OH functional requirements for the system concept based on component test results
- Assess OH impacts when rating concept alternatives at the functional level
- Assess and document risk of AF inability to meet training requirements at the functional level
- Validate planned OH methods for functional-level tasks

H

- Evaluate the conceptual system's overall ability to meet performance capability requirements within identified OH constraints
- Rate concept alternatives at this level to identify critical OH hazard risks and identify mitigation control measures
- Assess and document risk of AF inability to meet OH requirements at the system level
- Validate planned OH methods for system-level operations and tasks

I

- Recommend preferred approach for system concept with health hazard limitations
- Ensure control measures are implemented to mitigate or reduce hazard risks to acceptance level
- Finalize hazard analysis (*e.g.,* PHL) for each system concept
- Ensure any risks of AF inability to meet OH requirements, at the planned operational readiness level and OPSTEMPO, are documented and reflected in the program cost estimate and related program documents
- Update system-level requirements, as necessary, to record any new or revised OH requirements

---

ITR

- Identify applicable OH criteria for system
- Ensure concept has sufficient detail with respect to mitigation to support valid cost estimate
- Include information in PESHE
- Provide OH inputs to reflect the chosen materiel solution approach
- Provide OH assumptions, risks, and cost drivers

ASR

- Prepare results of ESOH hazard and risk analysis (*e.g.,* PHL) for each alternative and recommend level of effort required for Technology Development Phase
- Ensure requirements are consistent with user needs and OH standards
- Provide OH inputs and risks for alternative materiel solutions that have been identified

Trades

- Participate in trade studies to identify potential top-level OH hazards and ensure OH criteria are included

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Materiel Solution Analysis Phase

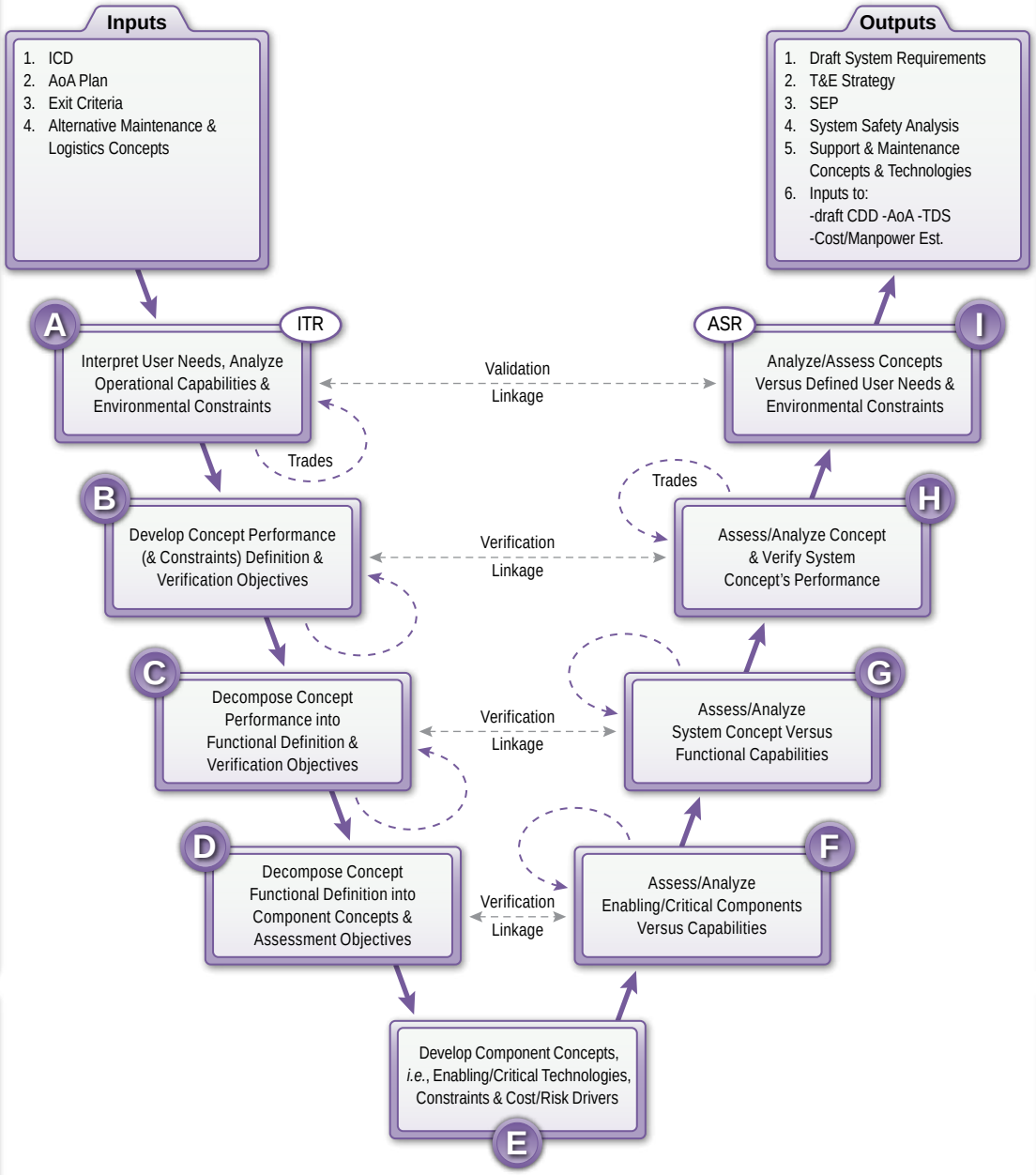
Habitability

Activities for Each Input:

1.0 Assist in defining the long-term human operating environment under consideration
1.1 Assist in aligning habitability criteria with mission requirements
1.2 Ensure consideration of minimal habitability factors which are those living and working conditions that are necessary to sustain safety, health, and comfort of the user population and directly contribute to personnel effectiveness and mission accomplishment. Factors include: nutrition, lighting, space, ventilation, and sanitation; noise and temperature control (*i.e.*, heating and air conditioning); and berthing, bathing, and personal hygiene
1.3 Coordinate inputs with other HSI domains related to habitability including manpower, personnel, HFE, and ESOH
2.0 Provide habitability inputs to AoA plan development
3.0 Develop habitability exit criteria
3.1 Ensure that notional habitability concepts are included in CONOPS and Logistics Concepts
4.0 Provide habitability inputs for maintenance facilities and activities

References:

- DODI 5000.02
- DAG
- NASA-STD-3001 Vol II



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Provide habitability inputs for preliminary system specifications for lighting, space, ventilation, nutrition and sanitation; noise and temperature control (*i.e.*, heating and air conditioning); and berthing, and personal hygiene
2.0 Provide habitability risk inputs to T&E strategy
2.1 Identify requirements for habitability simulations, mockups and test facilities
3.0 Provide habitability inputs to the HSIP
4.0 Coordinate with the System Safety Working Group to ensure habitability considerations are addressed in the SSA
5.0 Identify habitability concerns for maintenance and support concepts
6.0 Provide habitability KPPs as required
6.1 Review trade studies/technical demos for habitability constraints and risks
6.2 Provide inputs to the TDS for critical habitability technologies as required
6.3 Review and provide inputs to LCMP

Tools:

- NHV
- Index of Habitability
- IMPRINT, CATIA, JACK
- HSI Requirements Guide

Materiel Solution Analysis: Habitability

A

- Match habitability criteria against operational concepts, current doctrine, the intended system's mission, planned usage and support environment, and planned employment
- Determine habitability constraints, if any (resource-industrial base; notional available development, operation, and support budgets; required date for system fielding)
- Determine applicable habitability technologies available for use for concept maturation
- Review applicable guidance (DoD 5000-series; CJCSM/I guidance, *etc.*)
- Ensure all habitability drivers for the concept definition are completely captured and managed as an integral human-centered system

B

- Assess each system concept against identified habitability criteria and requirements
- Assess habitability trade spaces and risks for each alternative concept, both within related HSI domains and between other functional areas
- Ensure habitability criteria are well-defned and related to the capability needs
- Ensure verifcation planning considers the analysis, modeling, and test requirements needed to determine the ability of the conceptual system to meet requirements

C

- Ensure habitability concepts are included in functional definitions and verifcation objectives
- Ensure applicable habitability requirements, impacts, and risks, (for the tactical system, support systems, training system, *etc.*) are integrated into functional requirements
- Analyze and assess trade spaces and habitability risks against desired functional performance
- Ensure verifcation planning includes habitability requirements within each functional requirement

D

- Analyze and defne functional component design requirements, and compare with identifed habitability constraints
- Ensure verifcation planning includes habitability requirements within each component requirement

E

- Initiate identifcation of component habitability constraints
- Ensure habitability is adequately addressed in analyses, models and simulations, mockups and demonstrations.
- Review historical information (*e.g.,* successes, mishaps, lessons learned, poor human performance examples, *etc.*)
- Coordinate with other organizations who also address habitability issues like the Navy and National Aeronautics Space Administration (NASA) and review lessons learned

F

- Identify habitability requirements against critical component capabilities and support architectures
- Ensure habitability impacts are assessed when rating concept alternatives
- Ensure habitability goals contribute to the success of each functional component if required
- Assess and document risk of AF inability to meet habitability requirements at the component level

G

- Ensure habitability attributes are integrated into the overall capability
- Assess habitability considerations in each of the functional areas and ensure habitability goals contribute to the overall capability of the system
- Assess and document risk of AF inability to meet habitability requirements at the functional level

H

- Evaluate the conceptual system's overall ability to meet performance capability requirements within identifed habitability constraints
- Rate concept alternatives at this level to identify critical habitability risks and mitigation control measures
- Verify each habitability component (nutrition, hygiene, space, *etc.*) is sufficiently considered to meet overall mission performance
- Assist lead SE and lead HSI in preparing for the ASR as required
- Assess and document risk of AF inability to meet habitability requirements at the system level

I

- Recommend a proposed approach that incorporates habitability concerns and trade-offs
- Finalize list of habitability risks and mitigation measures if applicable
- Ensure all risks of AF inability to meet habitability requirements, at the planned operational readiness level and OPSTEMPO, are documented and refected in the program cost estimate and related program documents
- Update system-level requirements, as necessary, to record any new or revised habitability requirements

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ITR

- Provide habitability inputs to refect the chosen materiel solution approach
- Provide habitability assumptions, risks, and cost drivers

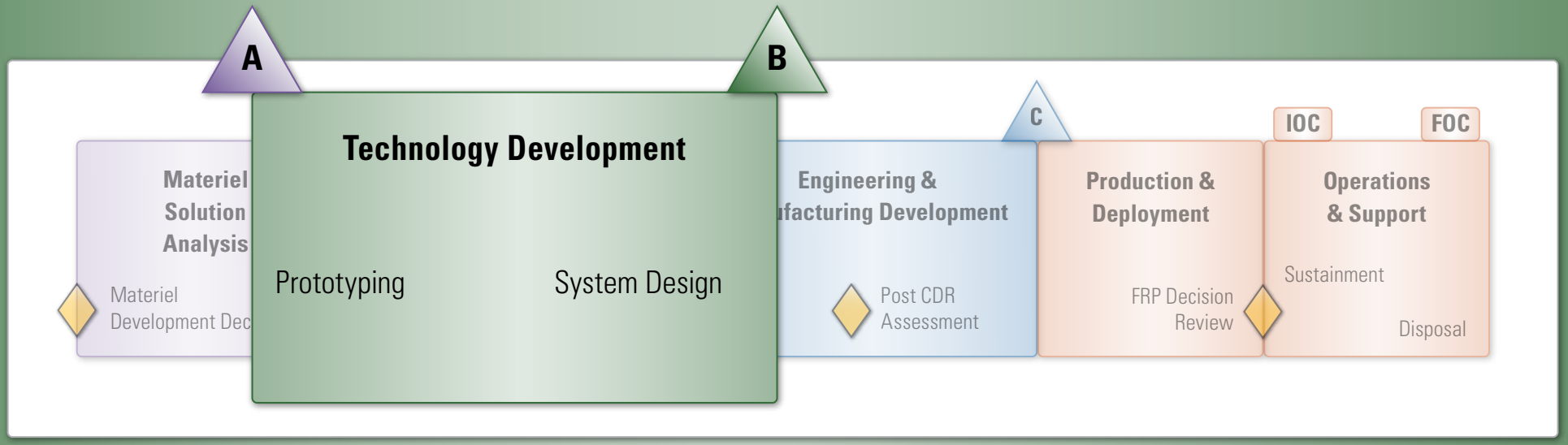
ASR

- Provide habitability inputs and risks for alternative materiel solutions that have been identifed

Trades

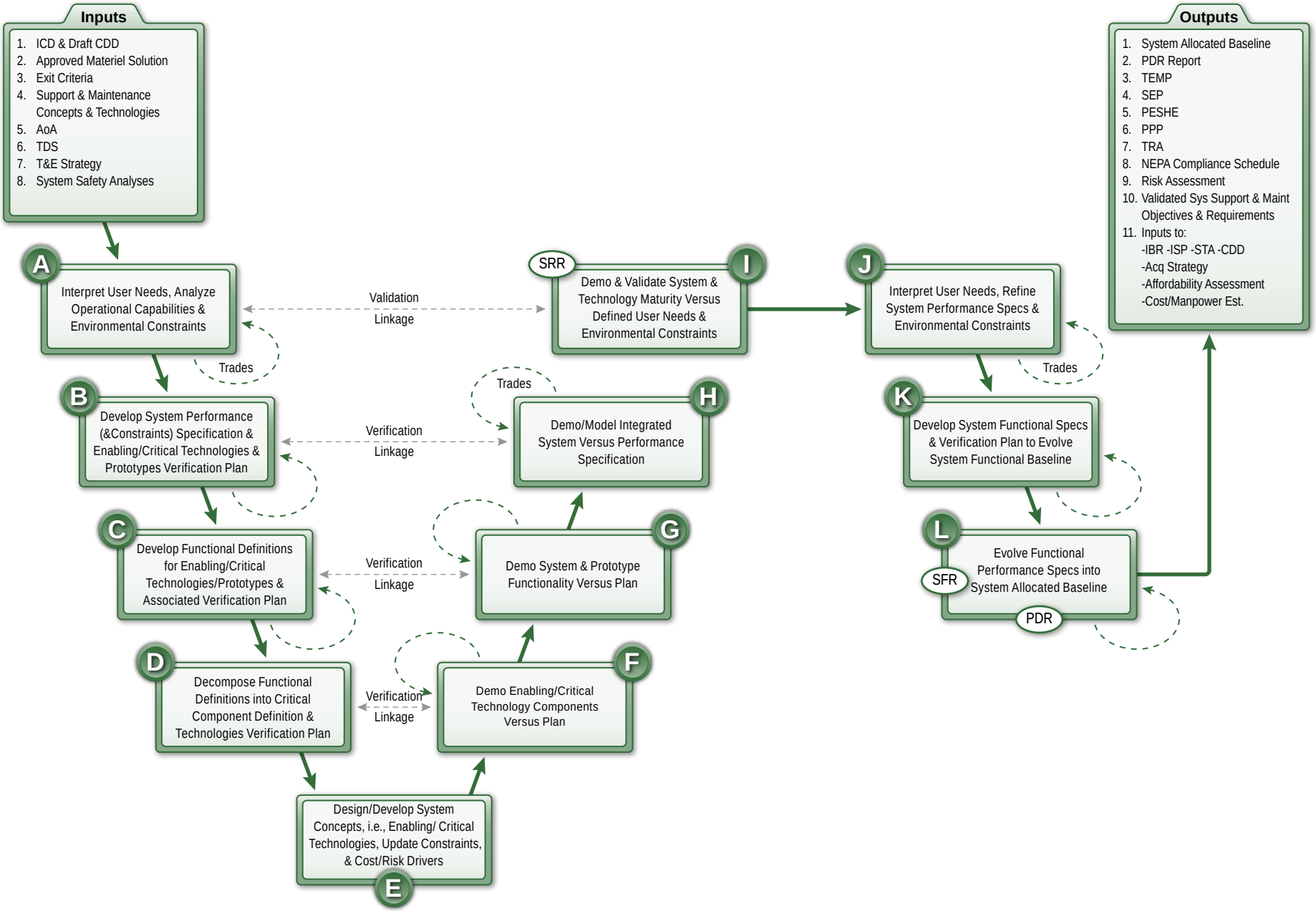
- Ensure habitability considerations are addressed in trade studies, alternative solutions, and proposed prototypes

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.



Technology Development—The purpose of this phase is to reduce technology risk, determine and mature the appropriate set of technologies to be integrated into a full system, and to demonstrate critical technology elements on prototypes. Technology Development is a continuous technology discovery and development process reflecting close collaboration between the S&T community, the user, and the system developer. It is an iterative process designed to assess the viability of technologies while simultaneously refining user requirements. (DODI 5000.02)

Technology Development Phase

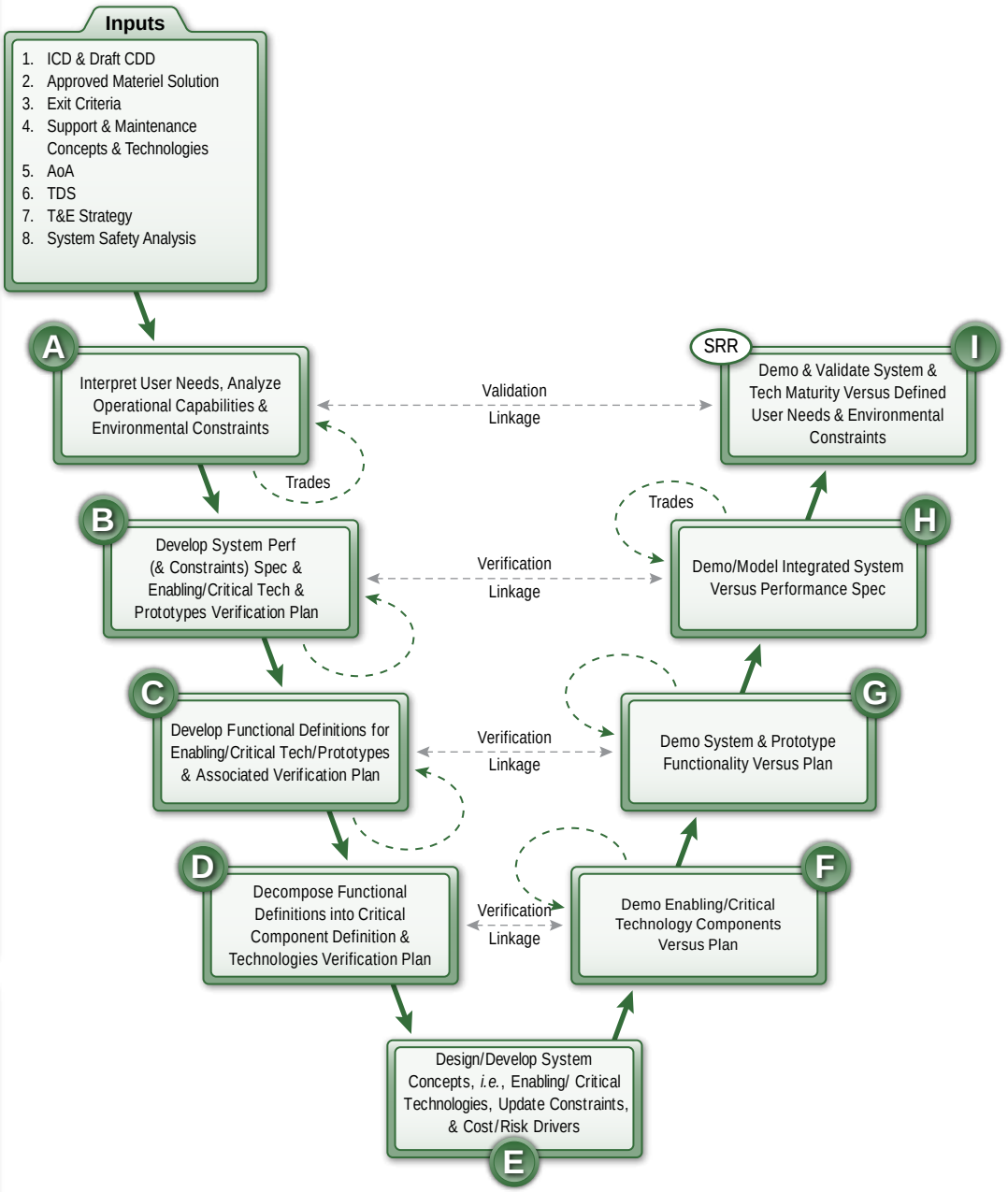


Technology Development Phase (Inputs)

Human Systems Integration

Activities for Each Input:

1.0 Update HSI domain effects
1.1 Review and update human constraints
2.0 Identify trade-off opportunities among domains
2.1 Evaluate requirements against concepts
2.2 Assess domain risks and impacts
3.0 Identify the key risks
3.1 Develop ESOH hazard and risk analysis (*e.g.*, PHL)
4.0 Assess HSI domain inputs for maintenance and support strategies
5.0 Identify associated risks for each alternative
5.1 Provide domain inputs for each alternative
5.2 Identify alternatives' strengths and weaknesses based on HSI domain trade-offs
6.0 Review domain inputs for proposed capabilities
6.1 Identify candidate HSI technologies for maturation based on Total Risk Assessment (TRA)
7.0 Prioritize HSI domain requirements for the chosen materiel solution
7.1 Distinguish risk controls and mitigation technologies
7.2 Verify process for HSI domain requirements verifcation
8.0 Develop safety analysis for each concept
8.1 Coordinate within domains to identify hazards



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- DODI 5000.02 & DODD 5000.01
- DAG
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

Tools:

- IMPRINT
- CATIA
- IPME

Technology Development Phase (Inputs): Human Systems Integration

A

- Identify critical HSI technology needs
- Assess HSI domain-specifc technology maturity to minimize impact on HSI domains

B

- Ensure HSI criteria are traceable back to defned system capabilities and constraints
- Identify HSI requirements in any system or subsystem performance specifcation, solicitation, contract, and evaluation criteria
- Defne HSI test requirements for identifed technologies

C

- Defne HSI criteria for weapon system, support, equipment, and training systems
- Assess HSI impacts from technology trade-offs or refnements
- Defne HSI test requirements for identifed technologies

D

- Update system HSI criteria
- Assess HSI impacts on hardware and software elements (physical interfaces, functional interfaces, standards, and existing technologies)
- Understand HSI impacts for system-of-systems technology
- Defne HSI testing and validation requirements for critical system components

E

- Address HSI risk areas within modeling and simulation demonstrations and analyses
- Identify and evaluate HSI constraints and risks associated with the overall system
- Revise HSI cost and risk drivers based on technology testing and validation

F

- Integrate evaluations of critical technologies across all functional areas
- Validate technology components against system component HSI requirements
- Participate in and evaluate demonstrations for HSI impacts with new technology components

G

- Evaluate critical technologies from an HSI perspective
- Review demonstration results for HSI-related constraints, risks, and opportunities
- Assess HSI impacts associated with trade-offs or component refnements

H

- Evaluate critical technologies from an HSI perspective
- Ensure HSI is properly refected in modeling and simulation engineering development models
- Review demonstration results for HSI-related constraints, risks, and opportunities
- Assess HSI impacts associated with accepted technology risks and system capabilities

I

- Ensure applicable HSI elements are embedded in the System Performance Specifcation and associated system development plans

---

SRR

- Validate HSI criteria against user requirements
- Ensure HSI requirements have been included in the Systems Performance Specifcation
- Ensure all HSI performance requirements that affect system requirements derived from the Capability Development Document (CDD) are testable and defned in the system functional baseline
- Ensure that HSI risks are included in the comprehensive risk assessment

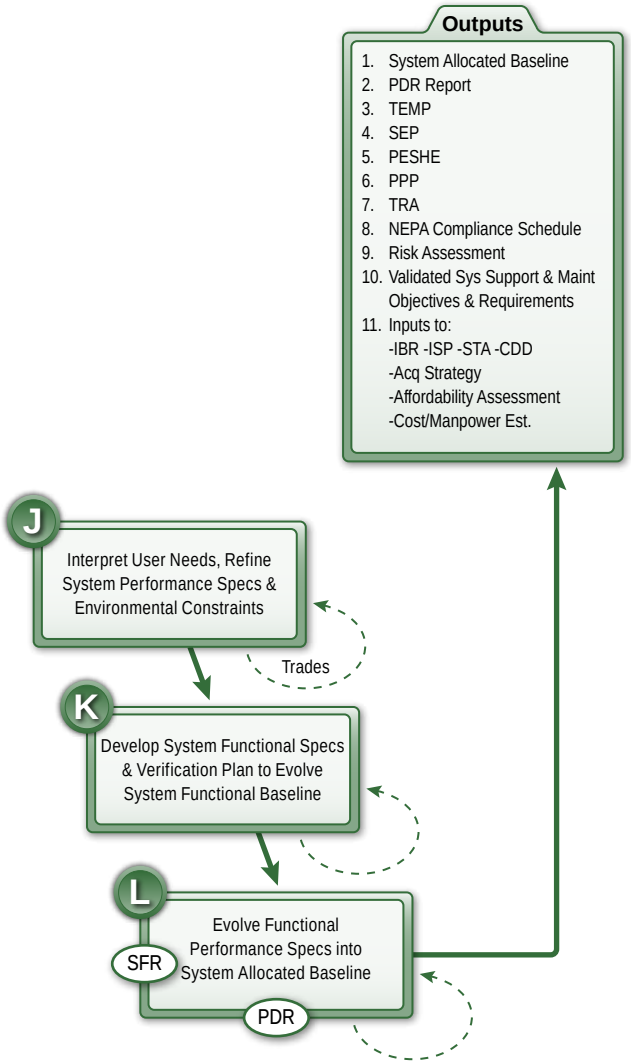
Trades

- Participate in AoA to ensure that HSI considerations have been addressed in the assessment of advantages and disadvantages
- Ensure trade space and risks analyzed include HSI considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Human Systems Integration



Activities for Each Output:

- 1.0 Incorporate domain considerations into baseline parameters
- 1.1 Identify domain performance requirements
- 1.2 Assign requirements to system components
- 2.0 Address all HSI concerns
- 2.1 Document HSI issues, concerns, risks, and action items
- 3.0 Provide HSI inputs for testing
- 3.1 Ensure HSI risk areas will be tested
- 3.2 Identify preliminary HSI test techniques
- 4.0 Include HSI planning
- 4.1 Include HSI inputs throughout
- 5.0 Include HSI integration strategy, risks, responsibilities, and hazard tracking process
- 6.0 Provide HSI inputs as needed
- 7.0 Update risk mitigation technology readiness levels
- 8.0 Review and update checklist items
- 9.0 Reassess HSI risks
- 9.1 Update HSI risks and inputs to other technology areas
- 10.0 Provide HSI inputs to support and maintenance requirements
- 11.0 Participate in compilation of the inputs with HSI
- 11.1 Provide HSI requirements and domain inputs as applicable
- 11.2 Update the Manpower Estimate Report (MER)

References:

- DODI 5000.02 & DODD 5000.01
- DAG
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

Tools:

- IMPRINT
- CATIA
- IPME

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Human Systems Integration

J

- Develop HSI profle and system boundaries across the life cycle
- Embed HSI in requirements and acquisition documentation *i.e.,* Initial Capabilities Document (ICD), CDD, Acquisition Program Baseline (APB), Systems Engineering Plan (SEP), Human Systems Integration Plan (HSIP), Test and Evaluation Master Plan (TEMP), Life Cycle Management Plan (LCMP), *etc.*
- Identify, develop, and document HSI-critical requirements and verify they are included in the requirements tracking system
- Include ESOH assessment (reference updated DAG, Chapter 4–Systems Engineering)

K

- Conduct HSI analysis and develop HSI risk metrics
- Research all subsystem Human-Machine Interface (HMI) and HSI requirements
- Review all trade studies for HSI impacts
- Expand HSI analysis to include functional specifcations
- Verify HSI-critical functional specifcations are included in requirements tracking system and in the System Verifcation Plan
- Verify National Environmental Policy Act Executive Order (NEPA/EO) 12114 requirements are being met at proposed testing and training locations
- Provide HSI updates for demilitarization/disposal planning
- Identify HSI requirements in system or subsystem solicitations or contracts

L

- Review updated ESOH hazard and risk analysis for HSI impacts [*e.g.,* Preliminary Hazard Analysis (PHA), System Hazard Analysis (SHA), Subsystem Hazard Analysis (SSHA), and Operations and Support Hazard Analysis (O&SHA)
- Review HSI-derived requirements for component, subsystem, and system to include test requirements
- Provide updated input for demilitarization/disposal planning
- Expand and update HSI limitations, risks, and attributes as detailed design specifcations evolve
- Verify HSI-critical design specifcations are included in requirements tracking system, detailed design specifcations, and in Confguration Item (CI) Verifcation Plan
- Address HSI in the Preliminary Design Review (PDR)

SFR

- Address HSI requirements in the system functional baseline and in conjunction with the lower-level performance requirements
- Ensure requirements, metrics, and development efforts associated with HSI are included in the program documentation and LCMP
- Ensure system requirements and the functional baseline are suffciently detailed to enable a reasonable cost estimate

PDR

- Ensure domain-specifc performance requirements are included in the preliminary design
- Review subsystem requirements to address HSI issues
- Ensure HSI design factors have been reviewed and included where needed in the overall system design
- Ensure HSI risks are identifed and manageable
- Ensure 100% of all safety-critical drawings are complete
- Ensure requirements, metrics, and development efforts associated with HSI are included in the program documentation and LCMP
- Evaluate the preliminary design for possible risks, design shortfalls, and undocumented requirements

Trades

- Conduct trade studies on threshold and objective levels of HSI requirements as the design matures
- Refne HSI-related key performance parameter thresholds and objectives with approval of requirements authority
- Participate in HSI-critical trade studies
- Review results of all trade studies
- Coordinate with other HSI domains to assess trade-offs within HSI and determine technology readiness

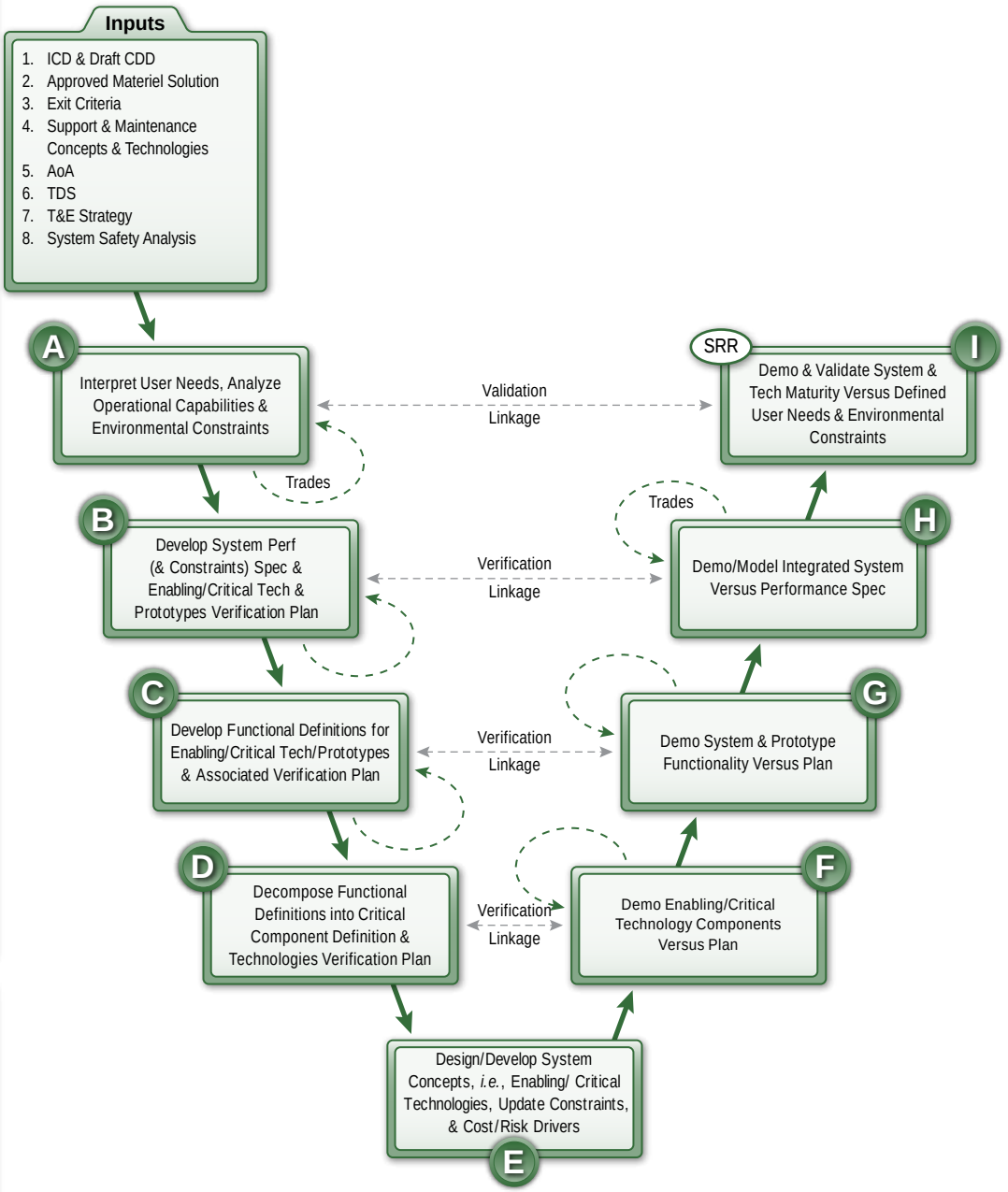
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Manpower

Activities for Each Input:

1.0 Identify any manpower limitations (*e.g.*, no growth)
1.1 Define manpower goals (*e.g.*, reduce human footprint to operate and maintain the new system compared to the legacy system
1.2 Use manpower limitations and goals to drive trade-off analyses
2.0 Compare the preferred system concept to the BCS
3.0 Develop manpower exit criteria
3.1 Ensure manpower concepts in CONOPS and Support Concepts are refined and updated
4.0 Compare concepts to BCS
5.0 Provide manpower costs for each alternative
6.0 Assess the schedule for POM synchronization
7.0 Incorporate manpower drivers into the T&E Strategy
7.1 Review the T&E Strategy to see if it can capture any preliminary manpower data
8.0 Review for potential manpower drivers



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References:

- CJCSI 3170.01
- AFI 38-201 & AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101
- AFMAN 63-119, Atch 9

Tools:

- AFMSs
- LCOM, CHRIS, MPES
- TDFA, TSSA
- Manpower Typicals

Technology Development Phase (Inputs): Manpower

A
- Review Defense Planning Guidance and POM documents for any funding constraints
- Check current National Defense Authorization and Appropriation Acts for changes on military and civilian end strength levels

B
- Identify gaps where the BCS is not applicable
- Seek alternative benchmarks for the system requirements not covered by the BCS

C
- Identify the system's projected operational tempo
- Assess functional definitions for potential manpower high drivers
- Update functional-level differences between the baseline system and alternatives

D
- Update system manpower criteria
- Develop requirements for verification of risk mitigation controls if applicable
- Update component-level differences between the baseline system and alternatives

E
- Assess system concepts for manpower impacts and for the potential to drive high manpower costs
- Update task lists for the various alternatives at the job/task level for tasks associated with operating, maintaining, and supporting the system
- Update manpower estimates for the alternatives at the job/task level for tasks associated with operating, maintaining, and supporting the system

F
- Evaluate enabling/critical technologies for manpower impacts and for the potential to drive high manpower costs
- Update manpower estimates for the new system (operation, maintenance, support based on the component-level differences between the baseline system and alternative systems
- Update manpower requirements for the training pipeline

G
- Review demonstration results for manpower issues and collect task frequency and time data

H
- Review demonstration results for manpower issues and collect task frequency and time data

I
- Review demonstration results for manpower issues and collect task frequency and time data

---

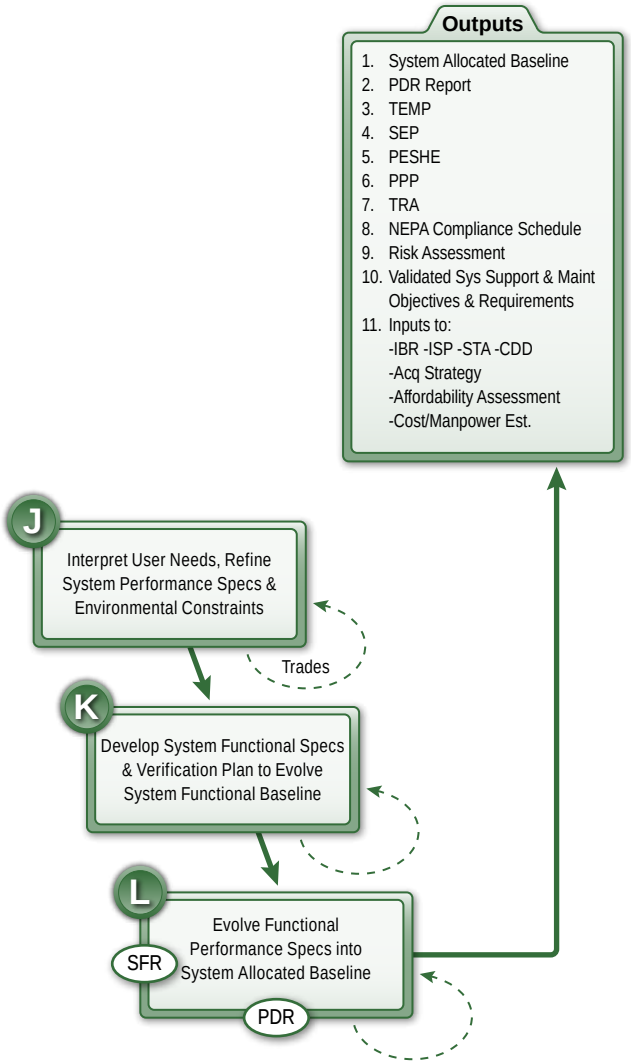
SRR
- Prepare and present manpower performance criteria at SRR if applicable
- Ensure that manpower risks are included in the comprehensive risk assessment

Trades
- Participate in trade studies to evaluate options against identified manpower criteria throughout this phase to ensure manpower concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include manpower considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Manpower



Activities for Each Output:

1.0 Review the baseline and assess manpower impacts
2.0 Provide inputs as requested
3.0 Continue to assess potential manpower drivers within the TEMP
3.1 Include a plan to capture task frequency and duration data during testing
4.0 Provide manpower inputs to SEP and HSI plan
5.0 Identify potential manpower drivers
6.0 Provide inputs as requested
7.0 Continue to assess risk of inability to meet manpower requirements
8.0 Review for potential manpower drivers
9.0 Continue to assess risk of inability to meet manpower requirements
10.0 Estimate maintenance manpower costs
11.0 Refne initial MER to refect data gathered to this point
11.1 Review and provide inputs to the LCMP

References:

- CJCSI 3170.01
- AFI 38-201 & AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101
- AFMAN 63-119, Atch 9

Tools:

- AFMSs
- LCOM, CHRIS, MPES
- TDFA, TSSA
- Manpower Typicals

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Manpower

J

- Review system performance specifcations
- Develop an initial process-oriented description for tasks associated with operating, maintaining, and supporting the system
- Identify the manpower standards impacted by these tasks and use them to estimate manpower requirements

K

- Identify manpower costs/exit criteria for system performance
- Estimate manpower costs for different system specifcations
- Provide trade-off assessments of manpower costs
- Task potential user commands for manpower inputs
- Determine initial manpower category mix (offcer, enlisted, civilian or contractor)
- Prepare POM input
- Provide a manpower input for demilitarization/disposal planning

L

- Adjust manpower impacts with each evolution of functional specifcations
- Assess and revise manpower requirements as needed following test and evaluation exercises
- Identify manpower costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted manpower estimates as needed
- Update manpower input for demilitarization/disposal planning

SFR

- Present manpower-critical requirements, costs, and risk status at SFR

PDR

- Ensure manpower costs are included in the Life Cycle Cost Estimate (LCCE) and the MER
- Provide manpower inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Ensure manpower risks are identifed and manageable

Trades

- Participate in trade studies to evaluate options against identifed manpower criteria throughout this phase to ensure manpower concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem manpower requirements
- Refne manpower-related threshold and objective requirements as needed based on the results of completed trade studies

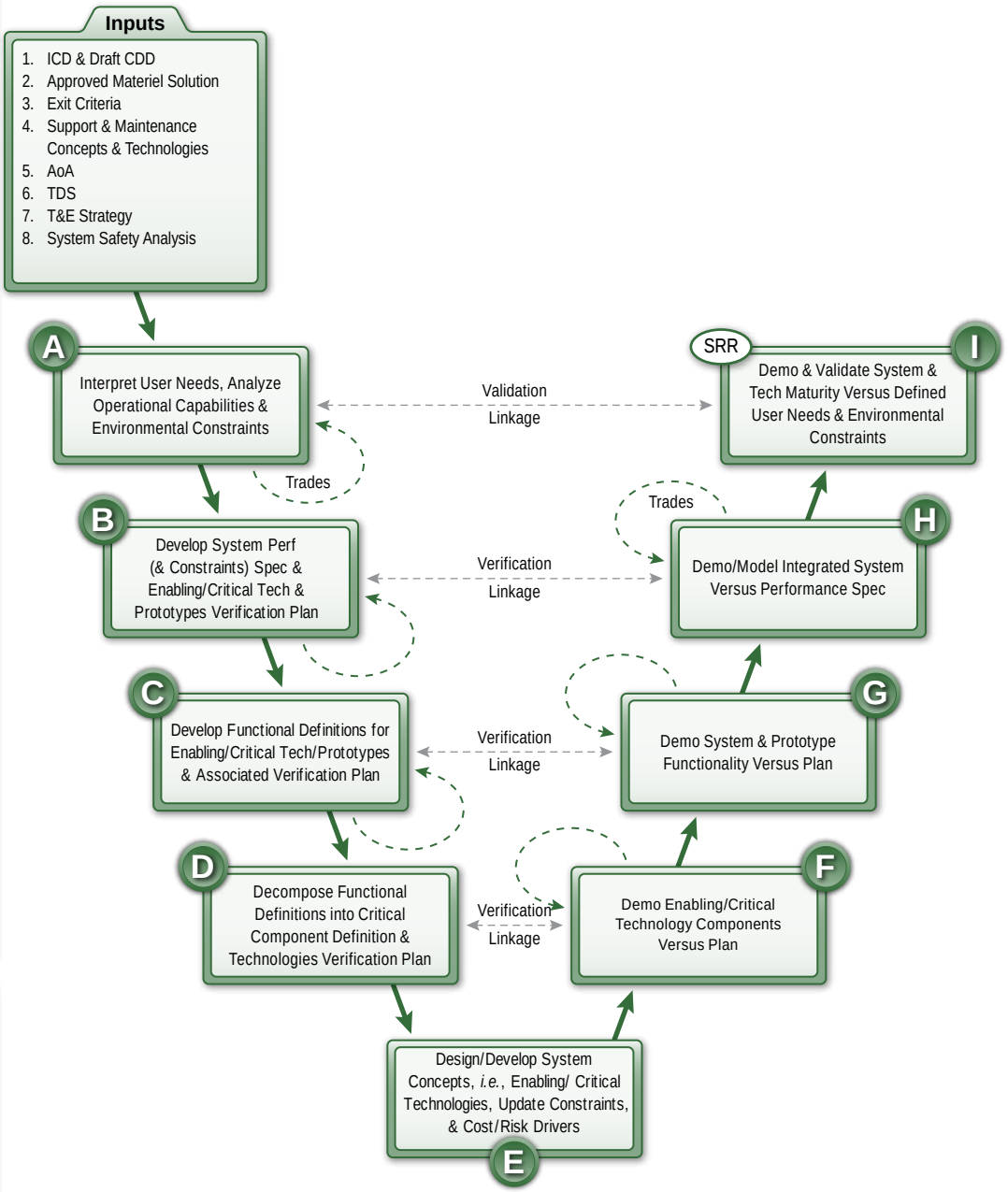
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Personnel

Activities for Each Input:

1.0 Ensure the ICD & CDD include the likely aptitude requirements of system operators, maintainers, and support personnel
2.0 Analyze differences between the preferred system concept and the BCS
2.1 Identify personnel ownership costs for the concept/materiel solution
3.0 Develop personnel exit criteria
3.1 Ensure personnel concepts in CONOPS and Support Concepts are refned and updated
4.0 Continue developing a TAD for the personnel needed for the support and maintenance concepts
5.0 Review AoA results to help assess potential personnel impacts of selected alternatives
5.1 Gather data on available personnel skill sets to assess alternatives
6.0 Assess the strategy schedule for potential recruiting implications and to anticipate future TPR/STR
7.0 Review and document the AFSCs and tasks associated with performing the T&E
8.0 Review for potential personnel impacts



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- CJCSI 3170.01
- AFI 63-101 & AFMAN 63-119, Atch 9
- AFPD 36-14 & AFI 36-3802
- AFPD 36-21 & AFPD 36-22
- AFI 36-2623 & AFI 36-2305
- AFI 36-2101 & AFI 36-2110

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect

Technology Development Phase (Inputs): Personnel

A
- Review current military and civilian personnel series to see which, if any, might be applicable for the new system
- Identify hard-to-fll series which are critical to operations and support of the new system

B
- Conduct a detailed analysis of personnel requirements for predecessor systems to project personnel requirements for the new system in terms of series, grades, and special experience or education

C
- Identify the system's projected operational tempo
- Assess functional defnitions for potential personnel high drivers

D
- Update system personnel criteria
- Develop requirements for verifcation of risk mitigation controls

E
- Assess system concepts for personnel impacts and potential to drive high personnel costs
- Review and update personnel inputs to CARD and LCCE

F
- Evaluate enabling/critical technologies for personnel impacts and for the potential to drive high personnel costs
- Review demonstration results for personnel issues and collect operations and support task data

G
- Review demonstration results for personnel issues and collect task data

H
- Review demonstration results for personnel issues and collect task data

I
- Describe the range of individual qualifcation requirements in all relevant physical, mental, physiological, biographical, and motivational dimensions
- Ensure this information is included in system requests for proposals and selected contractors are held accountable for designing the system to these human specifcations

---

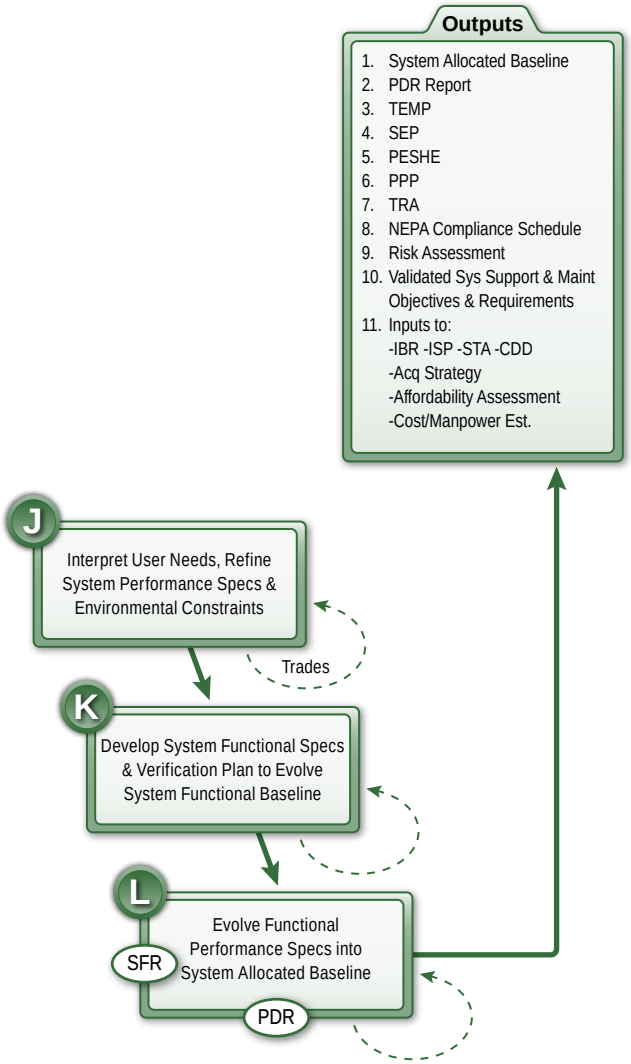
SRR
- Review and validate personnel performance criteria at SRR
- Ensure functional allocations to human performance are thoroughly documented and are reasonable
- Ensure that personnel risks are included in the comprehensive risk assessment

Trades
- Participate in trade studies to evaluate options against identifed personnel criteria throughout this phase to ensure personnel concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include personnel considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Personnel



Activities for Each Output:

1.0 Review the baseline and assess personnel impacts
2.0 Provide inputs as needed
3.0 Continue to assess potential personnel drivers within the TEMP
3.1 Review the tasks required for insight on future personnel classifcations
3.2 Include a plan to capture personnel Knowledge, Skills and Abilities (KSA) data during testing
4.0 Provide personnel inputs to the SEP and HSIP
5.0 Identify any potential personnel issues
6.0 Provide inputs as needed
7.0 Continue to assess risk of inability to meet personnel requirements
8.0 Review and provide inputs as needed
9.0 Determine and characterize personnel risks
9.1 Ensure personnel concepts in the CONOPS and Support Concepts are refned and updated
10.0 Assess potential personnel impacts of support and maintenance requirements
11.0 Provide personnel lifecycle cost inputs for applicable documents
11.1 Review and provide inputs to the LCMP

References:

- AFPD 36-14
- AFPD 36-21 & AFPD 36-22
- AFI 36-3802 & AFI 36-2623
- AFI 36-2305
- AFI 36-2101 & AFI 36-2110
- AFI 63-101

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Personnel

J

- Review system performance specifcations
- Develop an initial personnel description for tasks associated with operating, maintaining, and supporting the system
- Identify the classifcation series and AFSCs impacted by these tasks

K

- Identify personnel costs/exit criteria for system performance
- Estimate personnel costs for different system specifcations
- Provide trade-off assessments of personnel costs
- Task potential user commands for personnel inputs, especially AFSCs, series, grades, and special experience/education
- Determine initial skill code mix to operate and support the system
- Prepare/review POM input
- Provide personnel input for demilitarization/disposal planning

L

- Adjust personnel impacts with each evolution of functional specifcations
- Assess and revise personnel requirements as needed following test and evaluation exercises
- Identify personnel impacts associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted personnel estimates as needed
- Provide updated personnel input for demilitarization/disposal planning

SFR

- Evaluate personnel-critical requirements, costs, and risk status as presented at SFR
- Note any discrepancies and issue action items as appropriate at SFR
- Assess the approved product support plan for consistency with SFR data products

PDR

- Ensure personnel costs are included in the LCCE and the MER
- Ensure personnel series and grade assumptions are documented in the cost analysis requirements document and the MER
- Assess the approved product support plan and updates for consistency with PDR data products
- Ensure personnel risks are identifed and manageable

Trades

- Participate in trade studies to evaluate options against identifed personnel criteria throughout this phase to ensure personnel concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Refne personnel-related threshold and objective requirements as needed based on the results of completed trade studies

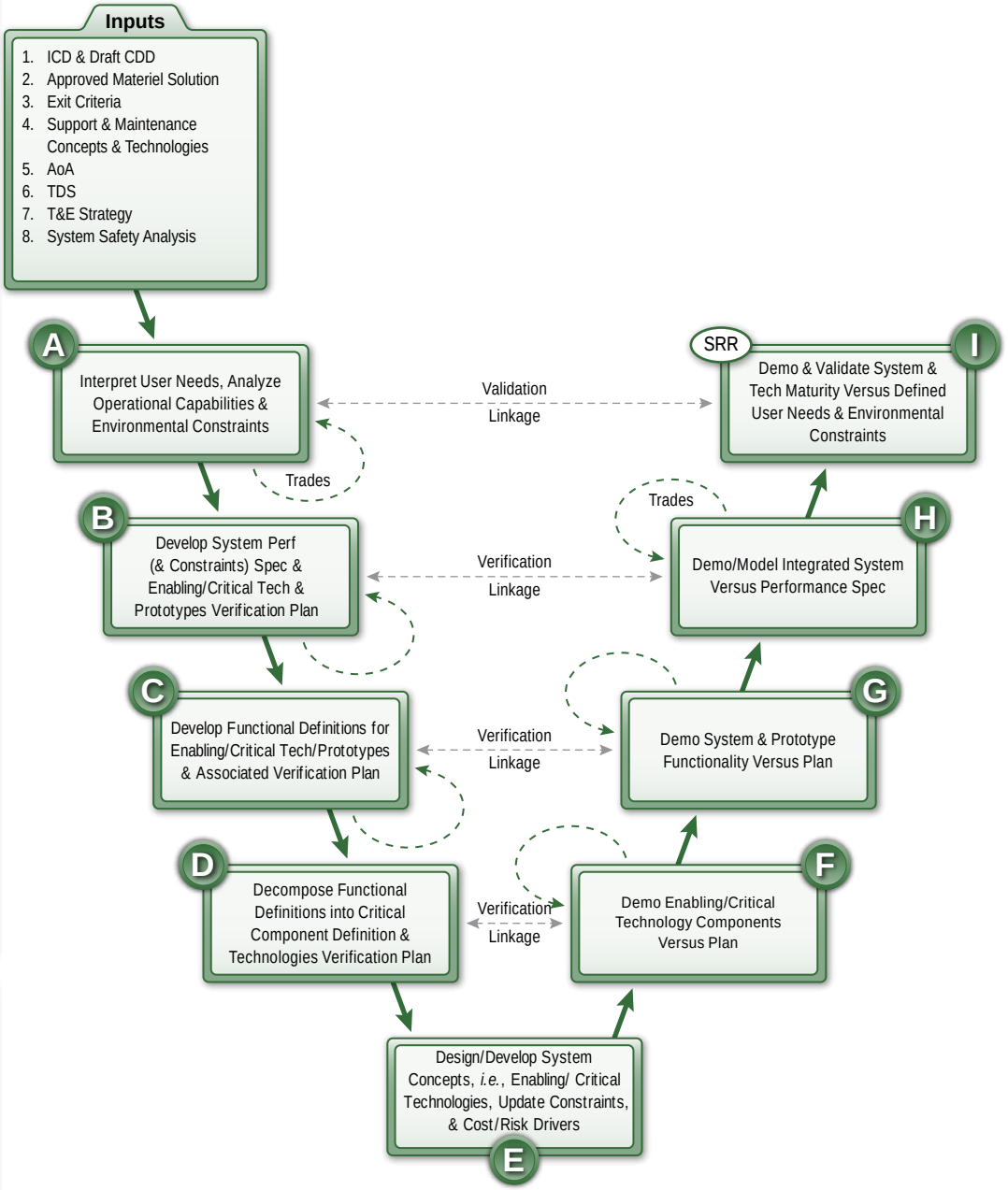
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Training

Activities for Each Input:

1.0 Review all available data
1.1 Draft initial training planning strategy
2.0 Identify preliminary training ownership costs for the materiel solution
3.0 Develop training exit criteria
4.0 Include training assessments
5.0 Analyze the BCS and assess training options and costs for each alternative
6.0 Assess types of training needed to support the new technology and associated costs
6.1 Determine if any technical manuals would need to be generated as exceptions in paper form
7.0 Identify training drivers within the T&E Strategy
7.1 Review test procedures to identify the types of tasks that will be required to operate and maintain the new system
7.2 Compare the potential tasks with existing Career Field Education and Training Plans (CFETPs) and other training material
7.3 Use this comparison to start anticipating training requirements for the new systems
8.0 Evaluate for training impacts



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3
- AFMAN 36-2234
- AFPD 36-22
- AFMAN 63-119, Atch 26

Tools:

- HPAT
- ADVISOR
- AIM

Technology Development Phase (Inputs): Training

A

- Identify the types of training required *e.g.,* unit, individual, classroom, computerized, on-the-job (OJT)
- Conduct a detailed analysis of training requirements for the BCS to project training requirements for the new system

B

- Identify gaps where the BCS is not applicable
- Seek alternative benchmarks for the system requirements not covered by the BCS
- Develop performance specifications for any trainers/simulators needed for training associated with the system under development

C

- Review BCS training materials for applicability
- Assess functional definitions for potential training drivers

D

- Update system training criteria
- Develop requirements for verification of risk mitigation controls

E

- Assess system concepts for training impacts
- Assess status of any new facility construction needed to support training

F

- Evaluate enabling/critical technologies for training impacts

G

- Review demonstration results for training issues

H

- Review demonstration results for training issues

I

- Review demonstration results for training issues

SRR

- Prepare and present training performance criteria at SRR
- Validate training criteria against user requirements
- Ensure all training performance requirements that affect system requirements derived from the CDD are testable and are defined in the system functional baseline
- Ensure that training risks are included in the comprehensive risk assessment

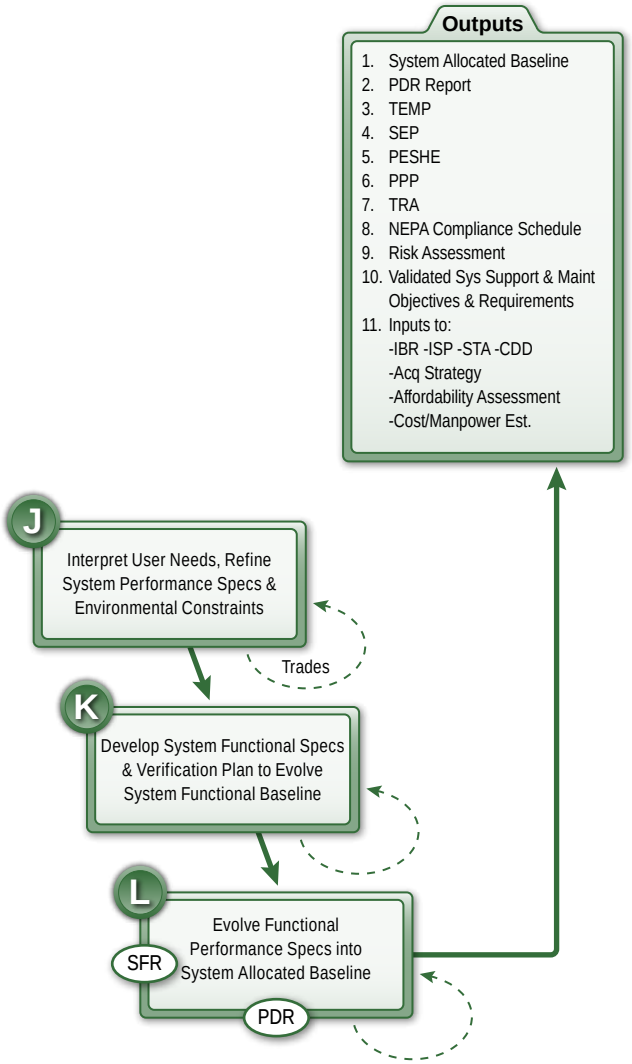
Trades

- Participate in trade studies to evaluate options against training costs throughout this phase to ensure training concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include training considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Training



Activities for Each Output:

- 1.0 Review the baseline and ensure it includes initial training projections
- 2.0 Review the preliminary design and develop a system performance task list
- 2.1 Identify preliminary operations and maintenance training requirements
- 3.0 Continue to assess training drivers within the T&E strategy
- 3.1 Refne the system task list based on procedures in the TEMP
- 4.0 Develop the initial training plan
- 5.0 Identify any new training needed to comply with PESHE
- 6.0 Provide inputs as needed
- 7.0 Provide inputs as needed
- 8.0 Assess for training drivers
- 9.0 Continue to assess risk of inability to meet training requirements
- 10.0 Identify training requirements for system support and maintenance
- 10.1 Evaluate options for government versus contractor training
- 10.2 Evaluate status of development of trainers/ simulators associated with the system
- 11.0 Determine realistic training goals and constraints
- 11.1 Review and provide inputs to the LCMP

References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3
- AFMAN 36-2234
- AFPD 36-22

Tools:

- HPAT
- ADVISOR
- AIM

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Training

J

- Review system performance specifcations
- Develop an initial BCS task description for tasks associated with operating, maintaining, and supporting the system
- Identify the impacted tasks for the new system and use them to estimate training requirements

K

- Identify training costs/exit criteria for system performance
- Estimate training costs for different system specifcations
- Provide trade-off assessments of differing training options and costs
- Task potential user commands for training inputs
- Determine training type mix (classroom, computerized, *etc.*)
- Prepare POM TPR/STR input
- Provide training inputs for demilitarization/disposal planning if needed

L

- Adjust training impacts with each evolution of functional specifcations
- Assess and revise training requirements as needed following test and evaluation exercises
- Identify training issues and costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted training inputs as needed
- Update training inputs for demilitarization/disposal planning if applicable

SFR

- Present training-critical requirements, costs, and risk status at SFR

PDR

- Ensure training costs are included in the LCCE and the MER
- Review product specifcations for training considerations
- Provide training inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Ensure training risks are identifed and manageable

Trades

- Participate in trade studies to evaluate options against training costs throughout this phase to ensure training concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem training
- Refne training-related threshold and objective requirements as needed based on the results of trade studies

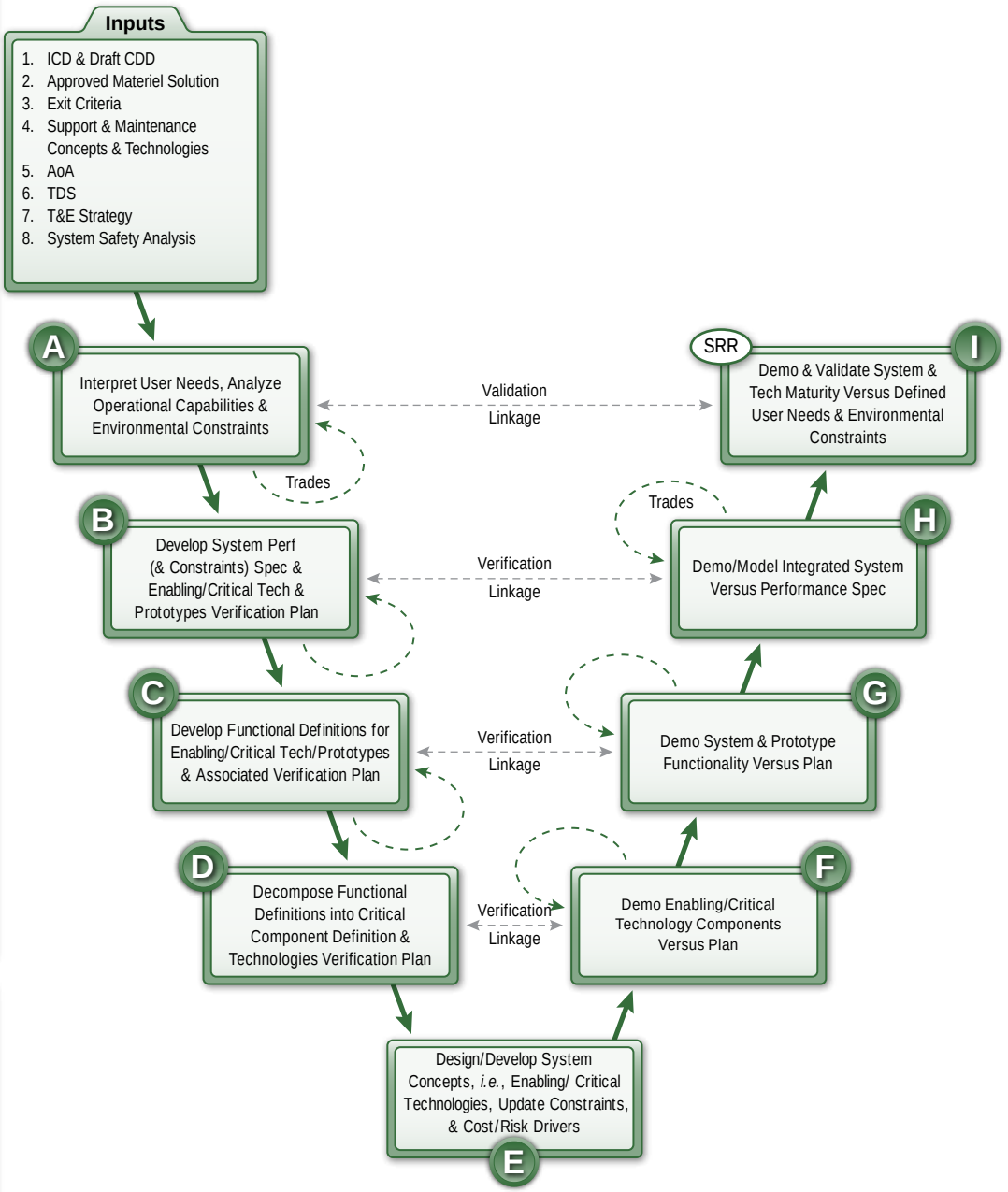
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Human Factors Engineering

Activities for Each Input:

1.0 Develop HFE criteria and requirements
1.1 Identify HFE constraints and performance attributes for the system
1.2 Provide HFE input to key performance parameter (KPP) development
2.0 Evaluate system concept against identified HFE criteria
2.1 Develop HFE documentation for contract & in-house program documents
3.0 Develop HFE exit criteria
3.1 Update strategy for integrating HFE risk management into SE
3.2 Ensure that HFE concepts in CONOPS and Support/Logistics Concepts are refned and updated
4.0 Incorporate HFE risk mitigation and test and verifcation methodologies
4.1 Include HFE planning strategy and requirements to support T&E
5.0 Perform Functional Flow Analysis
5.1 Perform Function Allocation
5.2 Perform Decision-Action Analysis
5.3 Perform Task Analysis
5.4 Perform Time-Line Analysis
5.5 Perform Workload Analysis
6.0 Perform Decision-Action Analysis
7.0 Incorporate HSI inputs
8.0 Develop HFE documentation for contract and in-house program documents
8.1 Update technical documentation and program management plan with HFE requirements



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- AFI 63-101 & AFI 63-1201
- DODI 5000.02 & DODD 5000.01
- MIL-STD-1295A
- MIL-STD-1472 & MIL-STD-1478
- MIL-HDBK-46855

Tools:

- CATIA
- CSDT
- Delmia-Human
- IMPRINT
- IPME

Technology Development Phase (Inputs): Human Factors Engineering

A

- Update identifcation of HFE constraints
- Identify critical HFE technology needs
- Ensure HFE technology is mature

B

- Ensure HFE criteria is traceable back to defned system capabilities and constraints
- Include HFE critical specifcations in Verifcation Plan
- Defne HFE test requirements for identifed technologies
- Ensure specifc HFE requirements are included in the specifcation
- Identify HSI requirements in any system or subsystem performance specifcation, solicitation, contract, and evaluation criteria
- Defne HSI test requirements for identifed technologies

C

- Defne HFE criteria for tactical, support, and training systems
- Defne HFE test requirements for identifed technologies
- Assess HFE impacts from technology trade-off or refnements

D

- Update system HFE criteria
- Assess HFE impacts on hardware and software elements (physical interfaces, functional interfaces, standards, and existing technology)
- Understand HFE impacts for system-of-systems technology
- Defne HFE testing and validation for critical system components

E

- Verify modeling and simulation, demonstrations, and analyses address HFE concerns
- Understand and identify HFE constraints and risks associated with the overall system
- Revise HFE cost and risk drivers based on technologies testing and validation

F

- Evaluate critical technologies from an HFE perspective
- Validate technology components against system component HFE requirements
- Participate in and evaluate demonstrations for new technology components

G

- Evaluate critical technologies from an HFE perspective
- Review demonstration results for HFE related constraints, risks, and opportunities
- Assess HFE impacts associated with trade-offs or component refnements

H

- Evaluate critical technologies from an HFE perspective
- Ensure HFE is properly refected in modeling and simulation engineering development models
- Assess HFE impacts associated with acceptable technology risks and system capabilities
- Review demonstration results for HFE related constraints, risks, and opportunities

I

- Ensure applicable HFE elements are embedded in the System Performance Specifcation & associated system development effort

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SRR

- Ensure the preliminary set of HFE system requirements are allocated
- Ensure HFE system requirements satisfy the ICD and/or draft CDD
- Validate HFE criteria against user requirements
- Ensure measurable HFE requirements are clearly defned in the system performance specifcation
- Ensure all HFE performance requirements that affect system requirements are testable and are defned in the system functional baseline
- Ensure that HFE risks are included in the comprehensive risk assessment

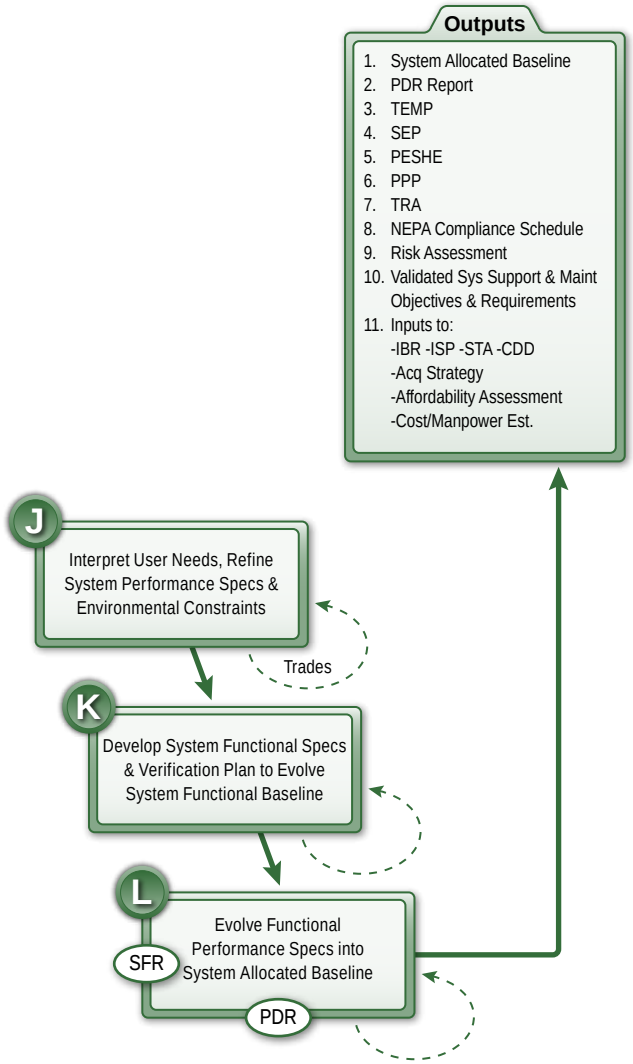
Trades

- Ensure HFE considerations are addressed in trade studies, alternate solutions and proposed prototypes
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include HFE considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Human Factors Engineering



Activities for Each Output:

- 1.0 Include HFE criteria, requirements and applicable specifcations
- 1.1 Require concurrence/approvals from the applicable HFE working groups
- 2.0 Provide HFE inputs
- 3.0 Determine HFE risk areas prior to inputs to the TEMP
- 3.1 Determine verifcation criteria for the designated HFE risk areas
- 4.0 Ensure HFE processes, measurement tools, and roles for HFE specialists are defned
- 4.1 Update strategy for integrating HFE into SE
- 4.2 Updated risk mitigation technology readiness levels
- 5.0 Provide HFE inputs as required
- 6.0 Provide HFE inputs as required
- 7.0 Update technology readiness assessments for HFE areas as required
- 8.0 Provide HFE inputs to supportability and maintenance facilities plans
- 9.0 Coordinate with system safety and update HFE inputs as required
- 10.0 Provide facility inputs for the Integrated Baseline Review
- 10.1 Identify HFE requirements, constraints, and attributes for the system
- 10.2 Develop proposed alternative approach for HFE verifcation
- 11.0 Ensure HFE inputs are in LCMP
- 11.1 Review cost/manpower estimates to update HFE inputs as required
- 11.2 Identify human system cost drivers

References:

- AFI 63-101 & AFI 63-1201
- DODI 5000.02 & DODD 5000.01
- MIL-STD-1295A
- MIL-STD-1478 & MIL-STD-1472
- MIL-HDBK-46855

Tools:

- 3DSSPP
- ACT-R
- AVOSCET
- BHMS, CATIA, CSDT
- ENOVIA, VAPS
- SALT, SAMMIE

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Human Factors Engineering

J

- Review selected technologies for HFE application
- Review System Performance Specification
- Identify the impacted tasks for the new system and use them to estimate HFE requirements

K

- Review HFE specifications and integrated range of applications to subsystems
- Identify HFE costs/exit criteria for system performance
- Estimate HFE application/verification costs for different system specifications
- Provide trade-off assessments of HFE solution/application options and costs
- Provide HFE updates for demilitarization/disposal planning

L

- Ensure HFE baseline consistency across hardware/software elements
- Ensure adequate HFE processes and metrics are in place
- Adjust impacts of HFE applications with each evolution of functional specifications
- Assess and revise HFE requirements as needed following test and evaluation exercises
- Identify HFE issues and costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specification changes and collect adjusted HFE inputs as needed
- Provide updated HFE input for demilitarization/disposal planning

SFR

- Ensure HFE system and functional performance requirements (per the CDD) are fully defned
- Ensure HFE consistent with the mature system concept and that adequate HFE processes and metrics are in place

PDR

- Ensure HFE requirements track with the system design
- Ensure an HFE baseline has been allocated and is consistent across hardware/software elements
- Ensure HFE risks are identifed and manageable

Trades

- Ensure HFE considerations are addressed in trade studies, alternate solutions and proposed prototypes
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem human factors
- Refne HFE-related threshold and objective requirements as needed based on the results of completed trade studies

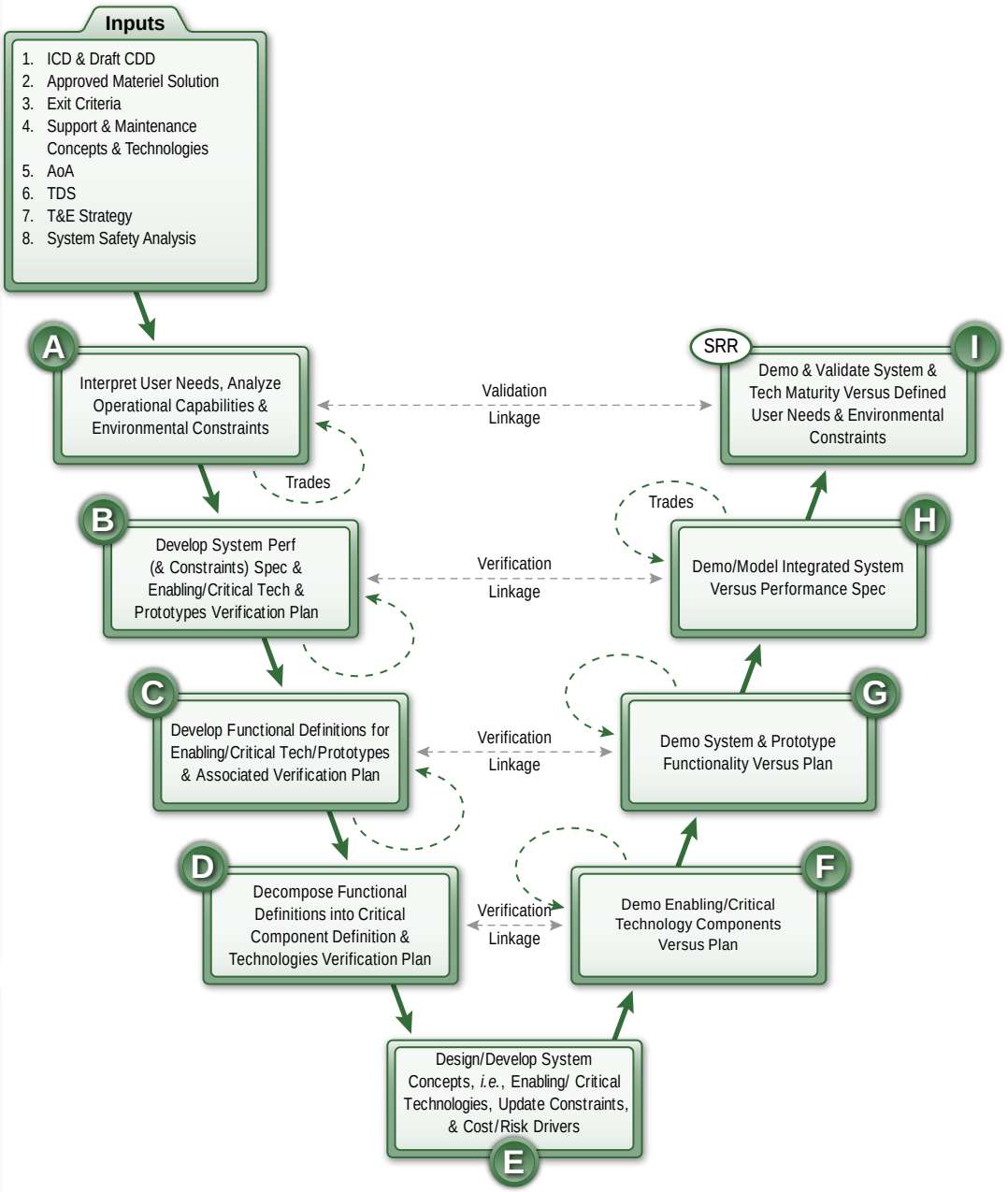
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Survivability

Activities for Each Input:

1.0 Develop Sv criteria and requirements
1.1 Identify Sv constraints and performance attributes for the system
2.0 Evaluate system concept against Sv criteria
3.0 Provide exit criteria to include an updated PAL and updated strategy for integrating Sv risk management into SE
4.0 Provide inputs from Sv requirements analysis
5.0 Characterize Sv footprints and risks for AoA development
6.0 Evaluate alternative Sv technical approaches
7.0 Incorporate risk mitigation test and verification methodologies and approach toward obtaining Sv risk acceptance
7.1 Include Sv planning strategy and requirements to support T&E
8.0 Initiate ESOH and hazard risk analysis for preferred concept [*e.g.*, Safety Requirements Criteria Analysis (SRCA) and PHL]



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- DODD 5000.01
- DODI 5000.02
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1201
- 10 USC 2366
- AFMAN 63-119 & AFI 90-901

Tools:

- PAL
- PAL-MATE
- ORCA
- BRAWLER, COVART
- ESAMS, FASTGEN
- RADGUNS

Technology Development Phase (Inputs): Survivability

A
- Update identifcation of Sv constraints
- Identify critical Sv technology needs

B
- Ensure Sv criteria are traceable back to defned system capabilities and constraints
- Identify Sv requirements in any system or subsystem specifcation, solicitation, contract, and evaluation criteria

C
- Update system Sv criteria
- Develop requirements for verifcation of risk mitigation controls

D
- Update system Sv criteria for critical components
- Defne Sv testing and validation for critical system components

E
- Update PAL
- Understand and identify Sv constraints and risks associated with the overall system
- Update Sv constraints

F
- Evaluate critical technologies from a Sv perspective
- Participate in and evaluate demonstrations for new technology components

G
- Evaluate critical technologies from a Sv perspective
- Review demonstration results for Sv related constraints, risks, and opportunities
- Assess Sv impacts associated with trade offs or component refnements

H
- Evaluate critical technologies from a Sv perspective
- Review demonstration results for Sv related constraints, risks, and opportunities

I
- Ensure applicable Sv elements are embedded in the System Performance Specifcation and associated system development effort

---

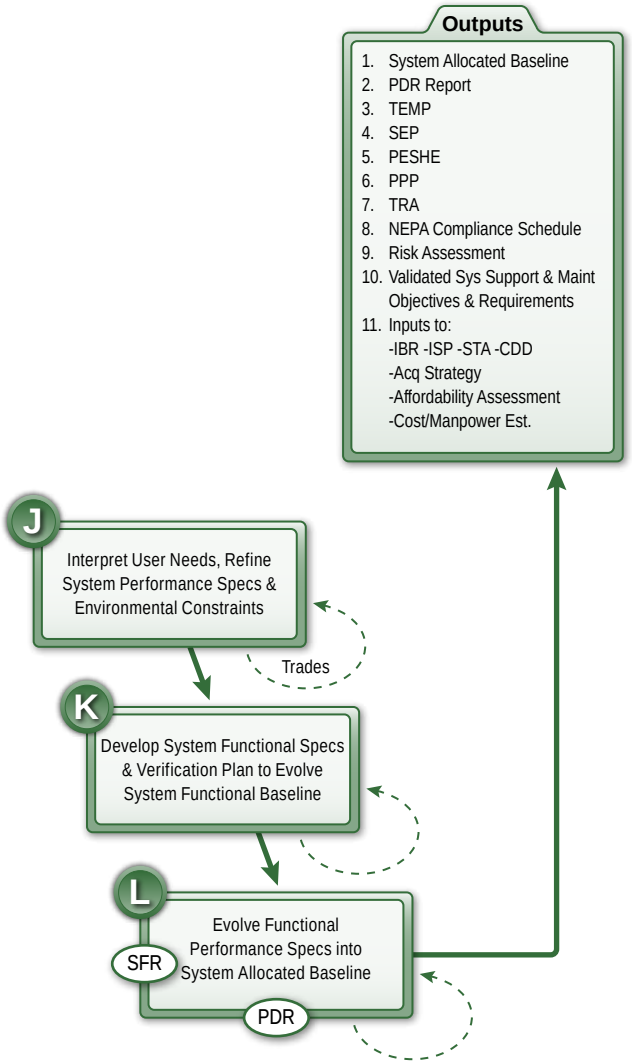
SRR
- Prepare and present Sv performance criteria at SRR
- Validate Sv criteria against user requirements
- Ensure measurable Sv requirements are clearly defned in the system performance specifcation
- Ensure all Sv performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline
- Ensure that Sv risks are included in the comprehensive risk assessment

Trades
- Participate in trade studies to evaluate options against identifed Sv criteria throughout this phase to ensure Sv concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include Sv considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Survivability



Activities for Each Output:

1.0 Identify performance requirements for each CI of the system
2.0 Evaluate Sv issues and concerns within identified system
3.0 Document Sv test requirements to include verification of risk mitigation controls
3.1 Include Sv planning strategy to support T&E
4.0 Update strategy for integrating Sv risk management into SE
5.0 Develop PESHE to include a preliminary Sv risk, strategy for integrating into SE, Sv responsibilities, and method for tracking hazard progress
6.0 Provide inputs as required
7.0 Update risk mitigation technology readiness levels
8.0 Include Sv issues and criteria
9.0 Identify Sv mitigation techniques for risk assessment
10.0 Provide preliminary requirements for system support and maintenance
11.0 Provide Sv mitigation and mishap reduction requirements
11.1 Incorporate summary of the PESHE in the Acquisition Strategy
11.2 Identify Sv requirements, constraints, and attributes for the system
11.3 Update LCMP in the acquisition strategy

References:

- DODD 5000.01
- DODI 5000.02
- 10 USC 2366
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1201
- AFMAN 63-119 & AFI 90-901

Tools:

- PAL
- PAL-MATE
- ORCA
- BRAWLER, COVART
- ESAMS
- FASTGEN
- RADGUNS

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Survivability

J

- Develop Sv profle and system boundaries across the life cycle
- Develop detailed HSI criteria
- Identify and/or develop Sv-critical requirements and verify they are included in the requirements tracking system

K

- Initiate development of Sv analysis and risk metrics
- Update Sv criteria
- Expand Sv analysis to include functional specifcations
- Verify Sv critical functional specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Identify Sv requirements in any system or subsystem solicitation or contract
- Provide updated input for demilitarization/disposal planning

L

- Assess ESOH hazard and risk analysis for Sv impacts (*e.g.,* PHA, SHA, SSHA and O&SHA)
- Update Sv criteria for components, subsystems, and systems to include test requirements
- Provide updated input for demilitarization/disposal planning
- Expand and update SRCA with Sv inputs as required as detailed design specifcations evolve
- Verify Sv-critical design specifcations are included in requirements tracking system, detailed design specifcations, and in CI Verifcation Plan

SFR

- Present Sv-critical functions and risk status at SFR
- Ensure Sv performance requirements that affect system requirements derived from the CDD have been addressed and are included in the system functional baseline

PDR

- Identify Sv hazards and risk status at PDR
- Ensure Sv risks are manageable
- Ensure Sv requirements are in product specifcations

Trades

- Participate in trade studies to evaluate options against established Sv criteria throughout this phase to ensure Sv concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem Sv
- Refne Sv-related threshold and objective requirements as needed based on the results of completed trade studies

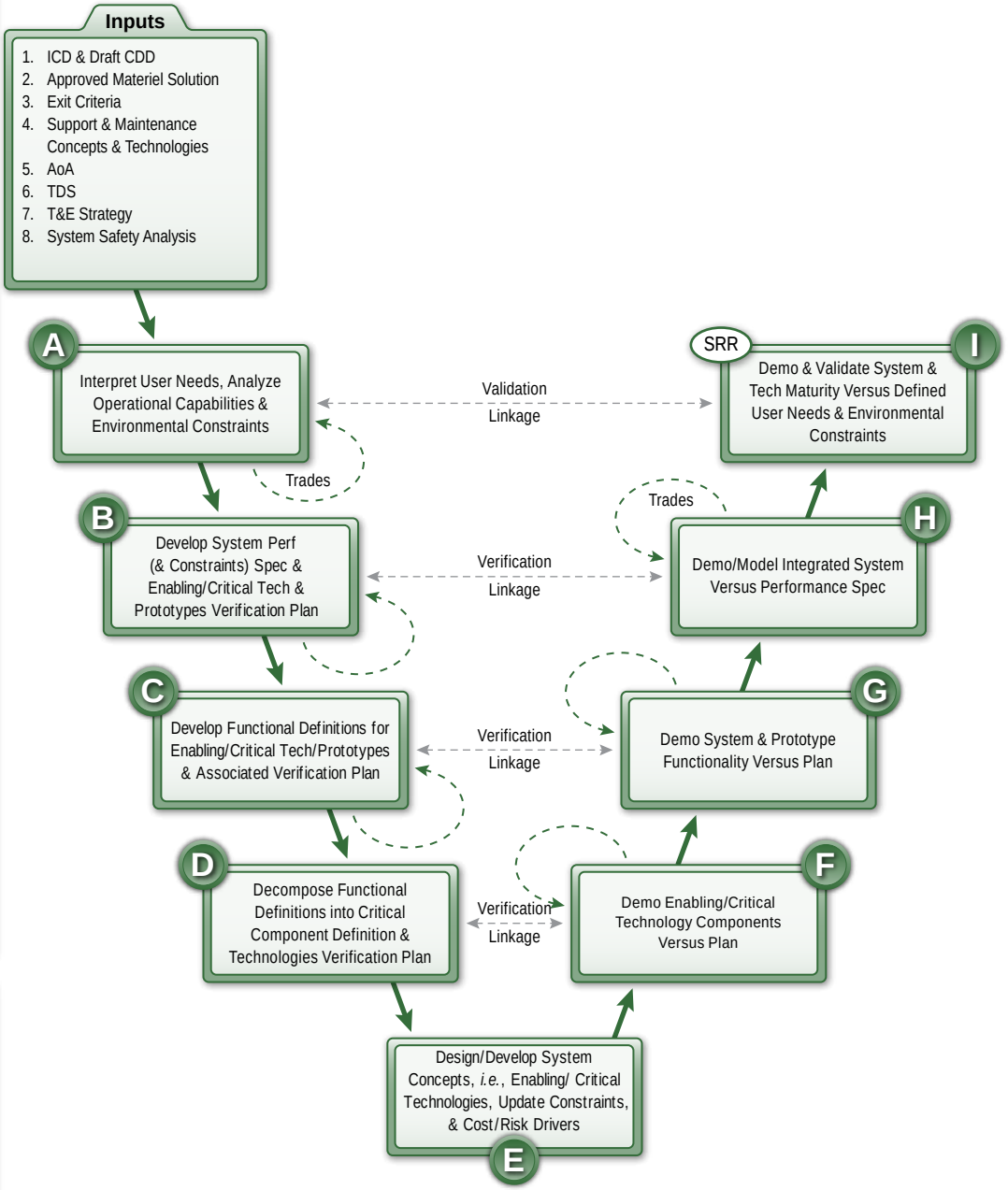
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Environment

Activities for Each Input:

1.0 Develop environment criteria and requirements
1.1 Identify environment constraints and system performance attributes
2.0 Evaluate approved solution against identified environment criteria
3.0 Update ESOH hazard and risk analysis (*e.g.*, PHL) and strategy for integrating environment risk management into SE as exit criteria
4.0 Review maintenance concepts to ensure consistency with operational environments, especially extremes—cold, heat, humidity, salt, dust, ice
5.0 Characterize environment footprints or risks for the AoA recommended alternative
6.0 Include strategy for integrating environment risk management into SE
6.1 Review ESOH hazard and risk analysis (*e.g.*, PHL) to capture TDS skills
7.0 Include strategy to identify hazards in T&E plan
7.1 Incorporate environment risk, mitigation, test, and verification methodologies
7.2 Provide approach towards obtaining environment releases and risk acceptance
7.3 Include environment planning strategy and requirements to support T&E
8.0 Initiate ESOH hazard and risk analysis for preferred concept



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- NEPA/EO 12114
- DODI 5000.02 & DODI 4715.4
- MIL-STD-882D & MIL-STD-1425A
- MIL-STD-1472 & MIL-STD-1474D
- AFI 63-1201 & AFI 32-7086
- AFI 90-901 & AFI 90-821
- NAS 411: HMMP

Tools:

- ESOH Programmatic Risk Assessment Toolset
- FHA
- FTA

Technology Development Phase (Inputs): Environment

A

- Identify critical environment technology needs
- Ensure environment technology development is planned appropriately
- Develop environment criteria
- Identify environment constraints

B

- Ensure environment criteria are traceable back to defned system capabilities and constraints
- Identify environment requirements in any system performance specifcation, solicitation, contract, and evaluation criteria
- Defne hazard test requirements for identifed technologies

C

- Assess environment and hazard impacts from technology trade-offs or refnements
- Defne hazard test requirements for identifed technologies

D

- Update environment criteria
- Assess environment hazard impacts on hardware and software elements (physical interfaces, functional interfaces, standards, and existing technology)
- Understand environment impacts for system-of-systems technology
- Defne hazard testing and validation for critical system components

E

- Defne environment criteria for tactical, support, and training systems
- Verify modeling and simulation, demonstrations, and analysis address environment concerns
- Understand and identify environment constraints and hazard risks associated with the overall system
- Revise environment cost and risk drivers based on technologies testing and validation

F

- Evaluate critical technologies from an environment perspective
- Validate technology components against system component environment requirements
- Participate in and evaluate demonstrations for new technology components to help identify potential environment impacts

G

- Evaluate system critical technologies from an environment perspective
- Review demonstration results for environment constraints, risks, and opportunities

H

- Evaluate environment critical technologies
- Review demonstration results for environment-related constraints, risks, and opportunities
- Assess environment impacts associated with acceptable technology risks and system capabilities

I

- Evaluate enabling technologies from an environment perspective
- Ensure applicable environment elements are embedded in the System Performance Specifcation and associated system development effort

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SRR

- Prepare and present environment performance criteria at SRR
- Ensure those criteria are consistent with program cost, schedule, risks, and other system constraints
- Ensure measurable environment requirements are clearly defned in the system performance specifcation
- Ensure all environment performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline
- Ensure that environment risks are included in the comprehensive risk assessment

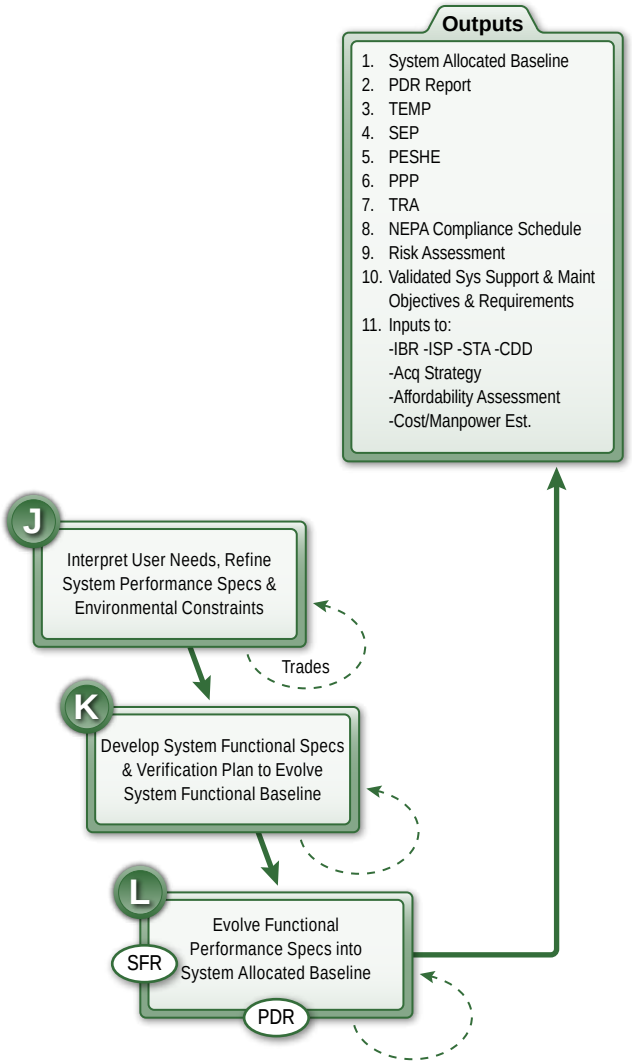
Trades

- Participate in trade studies to evaluate options against identifed environment criteria throughout this phase to ensure environment concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include environment considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Environment



Activities for Each Output:

- 1.0 Ensure inclusion of environment into baseline parameters
- 1.1 Include requirements and criteria for environment and SRCA data
- 2.0 Ensure environment issues and concerns are satisfactorily addressed at PDR
- 3.0 Document environment test requirements to include verif-cation of risk mitigation controls
- 3.1 Include environment planning strategy to support T&E
- 4.0 Update environment integration strategy and include considerations into SE, especially certif cations
- 5.0 Develop PESHE to include environment integration strategy, risks, responsibilities, and hazard tracking process
- 6.0 Provide inputs as necessary
- 7.0 Update risk mitigation technology readiness levels
- 8.0 Ensure compliance schedule is developed and is reasonable
- 8.1 Include environment hazard issues and criteria
- 9.0 Identify environment hazards and mitigation techniques for system risk assessment
- 10.0 Provide preliminary environment requirements for system support and maintenance
- 11.0 Review CDD for environment requirements
- 11.1 Review affordability assessment for adequate environment planning and funding
- 11.2 Review LCMP and provide inputs

References:

- NEPA/EO 12114
- DODI 5000.02 & DODI 4715.4
- MIL-STD-882D & MIL-STD-1425A
- MIL-STD-1474D & MIL-STD-1472
- AFI 63-1201 & AFI 32-7086
- NAS 411: HMMP
- AFMAN 63-119 & AFI 90-901

Tools:

- ESOH Programmatic Risk Assessment Toolset
- FHA
- FTA
- PESHE Checklist

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Environment

J

- Develop a life cycle environment profle and system constraints
- Develop detailed environment system criteria
- Verify environment inputs in acquisition documentation (*i.e.,* capabilities documents)
- Identify and develop environment critical and asset requirements and verify they are included in the requirements tracking system

K

- Initiate development of ESOH hazard and risk analysis [*e.g.,* PHA and Threat Hazard Assessment (THA)]
- Update environment criteria for system specifcations
- Review all trade studies for environment impacts
- Expand SRCA to ensure functional environment specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Identify environment requirements in any system or subsystem solicitation or contract
- Verify NEPA/EO 12114 requirements are being met at the proposed testing and training locations
- Provide environment updates for demilitarization/disposal planning

L

- Update ESOH hazard and risk analysis for environment impacts (*e.g.,* PHL, SHA, SSHA, and O&SHA)
- Ensure documentation of environment impacts for SFR
- Update environment criteria for components, subsystems, and systems to include test requirements
- Expand and update SRCA as detailed design specifcations evolve
- Verify environment-critical design specifcations are included in the requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan
- Provide updated input for demilitarization/disposal planning

SFR

- Identify environment criteria and ensure all hazards and risks are considered and documented
- Ensure consistency of environment criteria with cost, schedule, risks, and other system constraints
- Ensure environment performance requirements that affect system requirements derived from the CDD have been addressed and are included in the system functional baseline

PDR

- Identify and initiate evaluation of environment hazards and issues as part of the total system
- Evaluate feasibility of NEPA compliance schedule
- Ensure environment risks are identifed and manageable

Trades

- Participate in trade studies to identify potential environment hazards
- Ensure environment criteria are considered during trade-offs during the Technology Development Phase
- Coordinate with other HSI domains to assess trade-offs with HSI
- Refne environment-related threshold and objective requirements as needed based on the results of completed trade studies

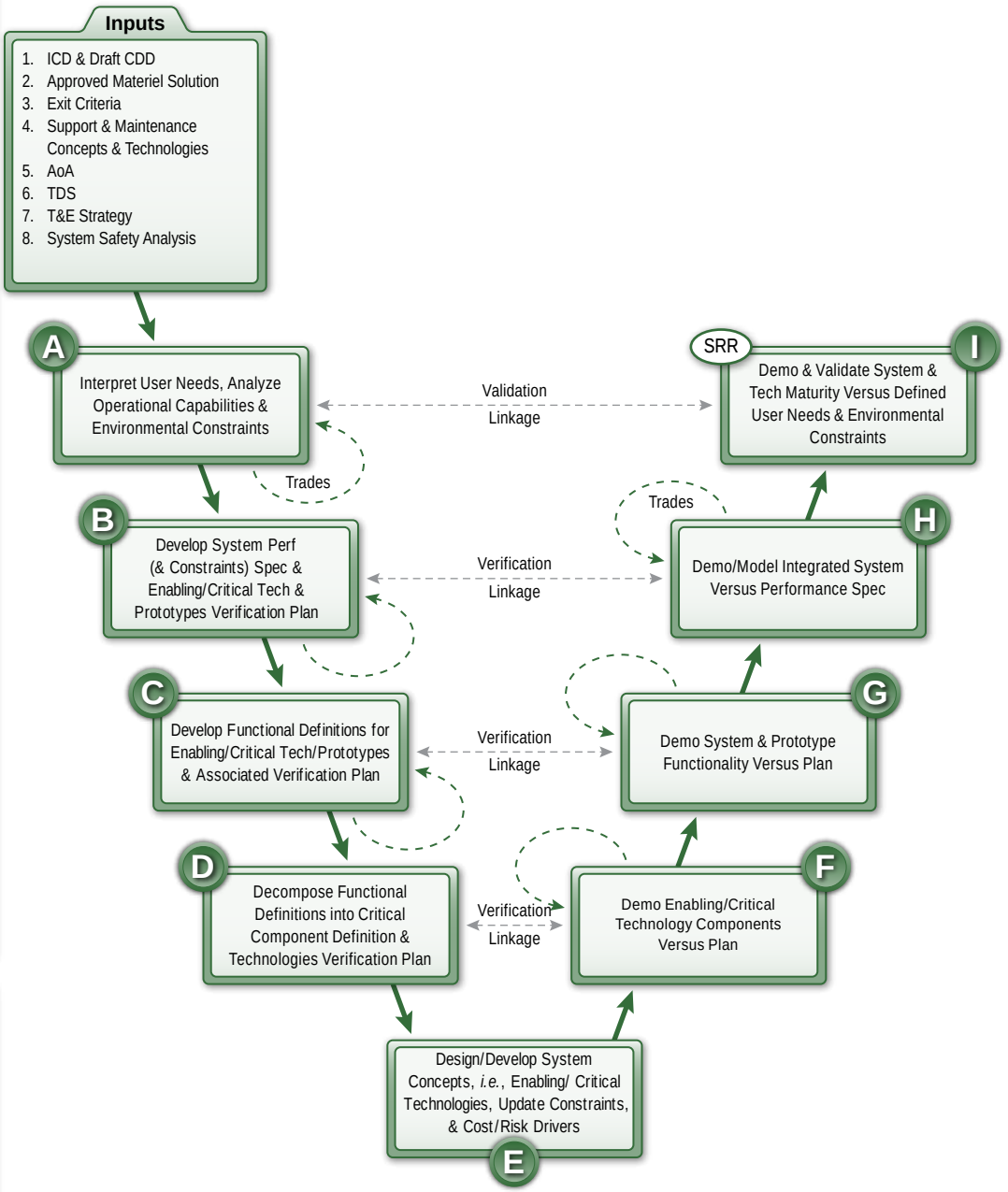
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Safety

Activities for Each Input:

1.0 Develop system safety requirements and criteria for capabilities documents
1.1 Identify safety constraints and system performance attributes
2.0 Define system safety design criteria
3.0 Update ESOH hazard and risk analysis (*e.g.*, PHL)
3.1 Update mishap reduction strategy
3.2 Define safety design integration plan
3.3 Revise safety and residual risk mitigation methodologies
4.0 Provide inputs for safety considerations
5.0 Characterize safety footprints or risks for AoA development and decisions
6.0 Define a strategy to address hazards
6.1 Identify needed safety technologies
7.0 Incorporate hazard risk mitigation test and verification methodologies
7.1 Incorporate safety release and risk acceptance levels
7.2 Address safety planning strategy and test and evaluation support requirements
8.0 Review analysis data and revise mishap prevention and safety design criteria



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- AFOSH Standards
- MIL-STD-882D
- DoD System Safety Handbook
- AFI 63-101 & AFI 63-1201
- AFI 90-901 & AFMAN 63-119
- DAG
- AFI 91 Series

Tools:

- ESOH Programmatic Risk Assessment Toolset
- ATB Model
- TSSA
- HMIRS
- HFACS, HFIX

Technology Development Phase (Inputs): Safety

A

- Address safety technology needs
- Verify maturity of critical safety technologies
- Develop safety criteria and identify constraints

B

- Ensure safety criteria are traceable to defned system capabilities
- Identify safety requirements in system performance specifcations, solicitations, contracts and evaluation criteria
- Defne test requirements for identifed mishap prevention and safety technologies

C

- Assess safety and hazard impacts from technology trade-offs or refnements
- Defne hazard test requirements for identifed technologies

D

- Update safety design criteria
- Assess safety hazards with hardware and software elements (physical interfaces, functional interfaces, standards)
- Analyze safety design parameters for system-of-systems technology
- Defne safety testing and validation methods for critical system components

E

- Defne safety criteria for support and training systems
- Address safety constraints and risk mitigation control measures associated with the overall system
- Revise safety cost and risk drivers based on testing and validation reports

F

- Evaluate safety impacts for all critical technologies
- Validate system component safety requirements for selected technologies
- Participate in and evaluate demonstrations
- Document safety design criteria and risks and revise component-level requirements

G

- Evaluate safety design criteria
- Evaluate safety during system demonstrations and prototyping events

H

- Review demonstration and modeling results against safety specifcations
- Assess safety impacts for identifed technology risks and system capabilities

I

- Evaluate safety of enabling technologies
- Ensure applicable safety elements are embedded in the system performance specifcations and system development efforts

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SRR

- Ensure safety requirements are defned, testable, and traceable to system capabilities and user requirements
- Validate safety criteria against user requirements
- Ensure measurable safety requirements are clearly defned in the system performance specifcation
- Ensure all safety performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline
- Ensure safety risks are included in the comprehensive risk assessment

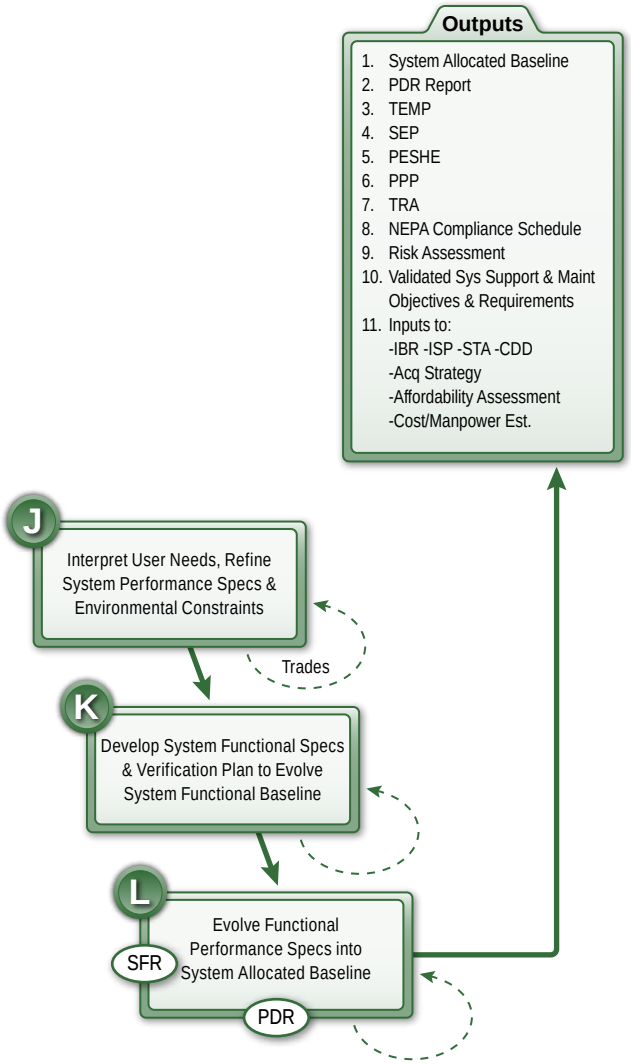
Trades

- Participate in trade-off studies to evaluate options against identifed safety criteria throughout the Technology Development Phase to ensure safety concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include safety considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Safety



Activities for Each Output:

- 1.0 Ensure inclusion of system safety design and requirements parameters
- 1.1 Include requirements and criteria for safety and SRCA data
- 1.2 Require concurrence/approval from applicable safety boards
- 2.0 Address safety in PDR
- 3.0 Document safety releases
- 3.1 Identify specifc test requirements to include verifcation of safety risk mitigation
- 3.2 Include safety test strategy and requirements
- 4.0 Update strategy for integrating safety risk management into SE
- 5.0 Document preliminary risks, integration strategies, and safety management responsibilities
- 5.1 Identify safety compliance schedules and approval/ concurrence processes
- 5.2 Ensure proper resourcing of safety
- 6.0 Provide inputs if requested
- 7.0 Update risk mitigation technology readiness levels
- 8.0 Monitor for reduction opportunities *e.g.*, HAZMAT
- 9.0 Document risk levels, mitigation control measures, and unmitigated risks
- 10.0 Revise preliminary safety requirements for system support and maintenance
- 11.0 Provide hazard mitigation and mishap reduction requirements
- 11.1 Incorporate PESHE into Acquisition Strategy
- 11.2 Include safety in LCMP update

References:

- AFOSH Standards
- MIL-STD-882D
- DoD System Safety Handbook
- AFI 63-101 & AFI 63-1201
- AFI 90-901 & AFMAN 63-119
- DAG
- AFI 91 Series

Tools:

- PESHE Checklist
- ESOH Programmatic Risk Assessment Toolset
- Cost Avoidance Methodology
- ORCA, HMIRS, HFACS, HFIX
- 3D System Safety Engineering Analysis

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Safety

J

- Develop safety life cycle profle and system boundaries
- Develop detailed safety criteria
- Embed safety inputs in acquisition documents
- Identify and develop safety critical and asset requirements and verify inclusion in requirements tracking system

K

- Develop ESOH hazard and risk analysis (*e.g.,* PHA and THA)
- Update safety criteria for system and functional specifcations
- Review trade-off studies for safety impacts
- Expand SRCA to ensure functional specifcations are included in the requirements tracking system and system verifcation plans
- Review safety requirements in system or subsystem solicitations or contracts
- Provide safety updates for demilitarization/disposal planning

L

- Update ESOH hazard and risk analysis (*e.g.,* PHA, SHA, SSHA, O&SHA)
- Update safety criteria for components, subsystems, and systems to include test requirements
- Expand and update SRCA as detailed design specifcations evolve
- Verify critical safety design specifcations are included in requirements tracking system, detailed design specifcations, and in the CI Verifcation plan
- Monitor for opportunities to reduce HAZMAT and personal protective equipment requirements
- Provide updated input for demilitarization/disposal planning

SFR

- Identify safety criteria and ensure all hazards and risks are considered and documented, including those associated with system operations and support
- Ensure all safety performance requirements that affect system requirements derived from the CDD have been addressed and are included in the system functional baseline

PDR

- Perform total system safety evaluation
- Ensure preliminary design decisions will not cause unacceptable safety hazards and mishaps
- Recommend PDR action items to resolve safety problem areas
- Provide safety inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Ensure safety risks are identifed and manageable

Trades

- Participate in trade studies to identify potential safety concerns and ensure they are addressed
- Ensure safety criteria are considered during trade-offs in the Technology Development Phase
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem safety
- Refne safety-related threshold and objective requirements as needed based on the results of completed trade studies

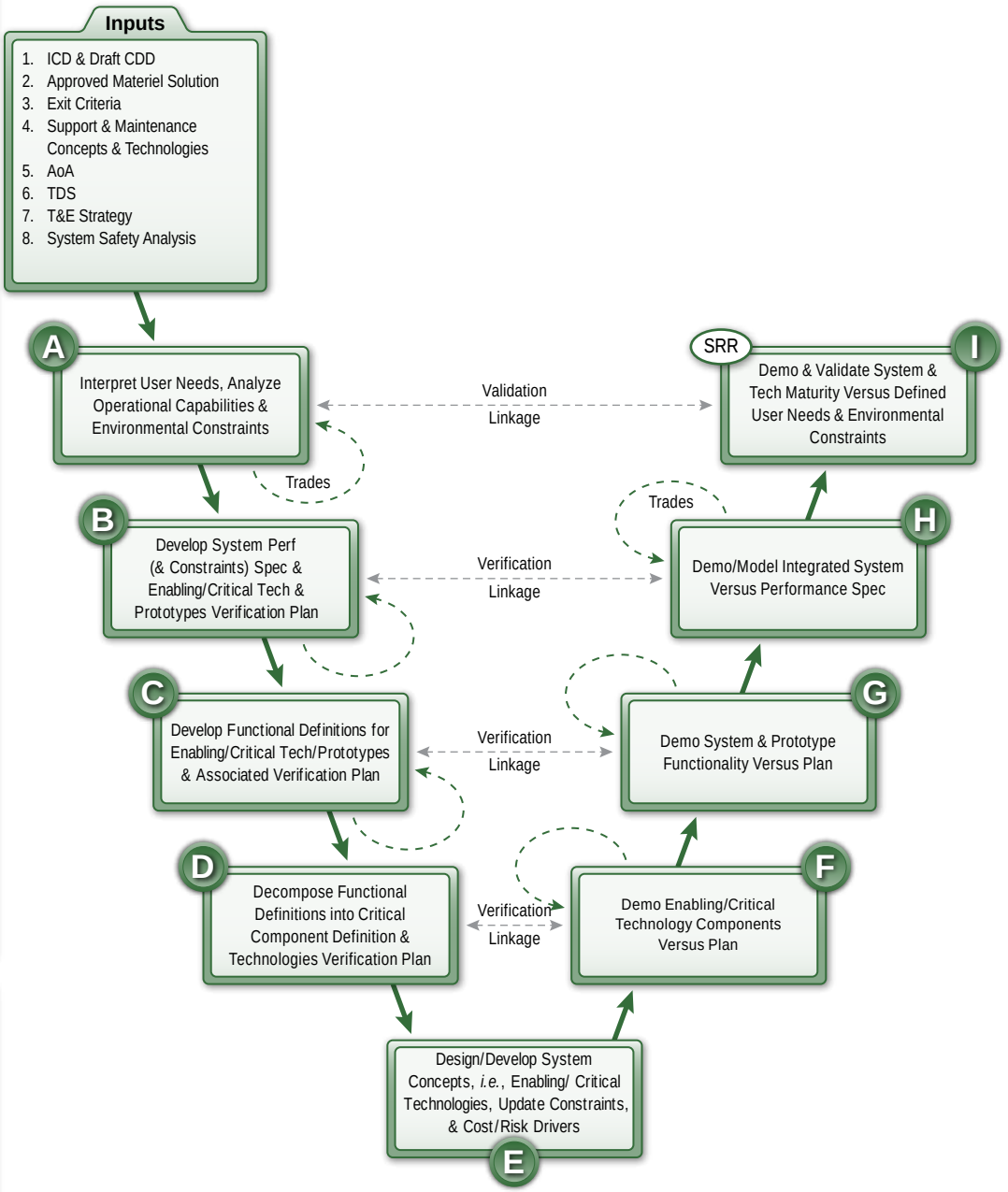
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Occupational Health

Activities for Each Input:

1.0 Develop OH requirements and criteria
1.1 Identify OH performance constraints and attributes for the system
2.0 Evaluate conceptual system against identifed OH criteria
3.0 Update ESOH hazard and risk analysis (*e.g.*, PHL)
3.1 Update integration strategy for risk management of OH into SE
4.0 Provide OH inputs into maintenance and logistics strategies
5.0 Characterize OH risks and requirements for each alternative
6.0 Include strategy for identifcation of hazards and OH technology development
7.0 Incorporate hazard risk mitigation, test and verifcation methodologies, and approach for risk acceptance
7.1 Include OH planning strategy and requirements to support T&E
8.0 Update ESOH and hazard risk analysis for preferred concept (*e.g.*, PHL and SRCA)



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- MIL-STD-882D
- DAG
- DODI 6055.05
- AFI 32-7086
- AFI 63-1201 & AFI 63-101
- AFPD 90-8
- AFMAN 63-119, Atch 25

Tools:

- HMIRS
- Cost Avoidance Methodology
- AHAAH
- BEE
- DOEHRS

Technology Development Phase (Inputs): Occupational Health

A

- Provide OH inputs to support SRR as required
- Identify critical OH technology needs
- Assess OH technology maturity to ensure TDS includes plan to mature OH technologies as required
- Develop OH criteria consistent with technology readiness levels
- Identify OH hazards and constraints on the human

B

- Ensure OH criteria are traceable back to defned system capabilities and constraints
- Identify OH requirements in any system performance specifcations, solicitation, contract, and evaluation criteria
- Defne hazard test requirements for identifed technologies and prototypes

C

- Assess OH and hazard impacts from technology trade-offs and refnements
- Defne hazard test requirements for identifed technologies and prototypes

D

- Update OH criteria for critical components
- Assess OH hazard impacts on hardware and software elements (physical interfaces, functional interfaces, standards, and existing technology)
- Understand OH impacts for system-of-system technologies
- Defne hazard testing and validation for critical system components

E

- Verify modeling and simulation, demonstrations, and analyses address OH concerns
- Understand and identify OH constraints and hazard risks associated with the overall system
- Revise OH cost and risk drivers based on technologies testing and validation
- Defne OH criteria for support and training systems

F

- Evaluate critical technologies components from an OH perspective
- Validate technology components against system component requirements
- Participate in and evaluate demonstrations for new technology components
- Document OH risks and revise component-level requirements

G

- Evaluate system critical technologies for OH hazards
- Review demonstration results for OH constraints, risks, hazards, and opportunities

H

- Assess OH impacts associated with acceptable levels of risk and system capabilities

I

- Evaluate enabling technologies for total system from an OH perspective
- Ensure applicable OH elements are embedded in the system performance specifcations and associated system development effort

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SRR

- Ensure OH requirements are defned, testable, and traceable
- Validate OH criteria against user requirements
- Ensure measurable OH requirements are clearly defned in the system performance specifcation
- Ensure all OH performance requirements that affect system requirements derived from the CDD are testable and defned in the system functional baseline
- Ensure OH risks are included in the comprehensive risk assessment

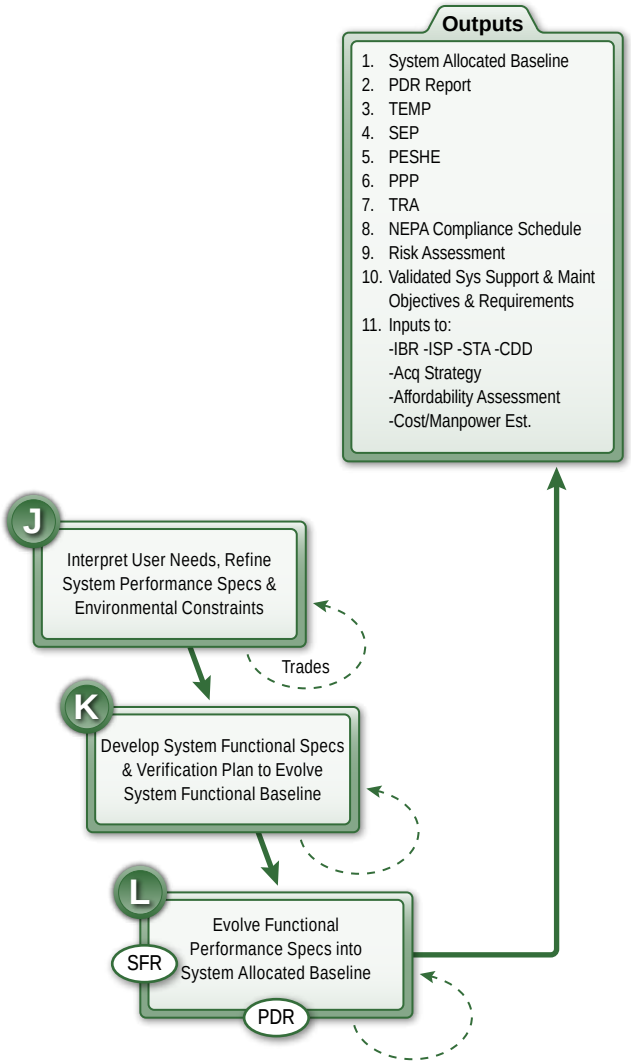
Trades

- Participate in trade-off studies to evaluate options against identifed OH criteria throughout the Technology Development Phase to ensure OH concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include OH considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Occupational Health



Activities for Each Output:

- 1.0 Ensure inclusion of OH into baseline parameters
- 1.1 Include requirements and criteria for OH and SRCA data
- 2.0 Ensure OH issues and concerns are fully addressed at PDR
- 3.0 Document OH test requirements to include verification of risk mitigation plans
- 3.1 Include OH planning strategy to support T&E
- 4.0 Update OH integration strategy and include considerations into SE
- 5.0 Develop PESHE to include OH integration strategy, risks, responsibilities, and hazard tracking process
- 6.0 Provide inputs as needed
- 7.0 Update risk mitigation technology readiness levels
- 8.0 Include OH hazard issues/criteria
- 9.0 Identify OH hazards and mitigation techniques for system risk assessment
- 9.1 Review contractor risk mitigation plans for OH
- 10.0 Provide preliminary OH requirements for system support and maintenance
- 11.0 Identify OH requirements, constraints, and system attributes in capabilities documents, strategy documents, and LCMP
- 11.1 Develop OH inputs for cost and manpower estimates in regards to hazards and mitigation plans

References:

- MIL-STD-882D
- DAG
- DoD System Safety Handbook
- DODI 6055.05
- AFI 32-7086
- AFI 63-1201 & AFI 63-101
- AFPD 90-8

Tools:

- HMIRS
- Cost Avoidance Methodology
- AHAAH
- ESOH Programmatic Risk Assessment Toolset
- PESHE Checklist
- BEE, DOEHRS

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Occupational Health

J

- Develop a life cycle OH profle and system restraints
- Develop detailed OH system criteria
- Verify OH inputs in acquisition documentation (*i.e.,* capabilities documents, system specifcations, *etc.*)
- Identify and develop OH critical requirements and verify they are included in the requirements tracking system

K

- Initiate development of ESOH hazard and risk analysis (*e.g.,* PHA and THA)
- Update OH criteria for system and functional specifcations
- Review all trade studies for OH impacts
- Expand SRCA to ensure functional OH specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Provide OH updates for demilitarization/disposal planning

L

- Update ESOH hazard and risk analysis for OH impacts (*e.g.,* PHL, SHA, SSHA, and O&SHA)
- Ensure documentation of OH impacts for SFR
- Update OH criteria for components, subsystems, and systems to include test requirements
- Expand and update SRCA as detailed design specifcations evolve
- Verify OH critical design specifcations are included in the requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan
- Review OH requirements in any system or subsystem solicitation or contract
- Provide updated input for demilitarization/disposal planning

SFR

- Identify OH criteria and ensure all hazards and risks are considered and documented, including those associated with system operations and product support
- Ensure OH performance requirements that affect system requirements derived from the CDD have been addressed and are included in the system functional baseline

PDR

- Identify and perform initial evaluation of OH hazards and issues as part of the total system
- Ensure OH risks are identifed and manageable
- Ensure preliminary design will not cause unacceptable OH issues
- Recommend PDR action items to resolve OH problem areas
- Provide OH inputs to the assessment of the system and subsystem preliminary design as captured in the confguration item specifcations

Trades

- Participate in trade studies to identify potential OH hazards and to ensure OH concerns are addressed
- Ensure OH criteria are considered during trade-offs during the Technology Development Phase
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem OH
- Refne OH-related threshold and objective requirements as needed based on the results of completed trade studies

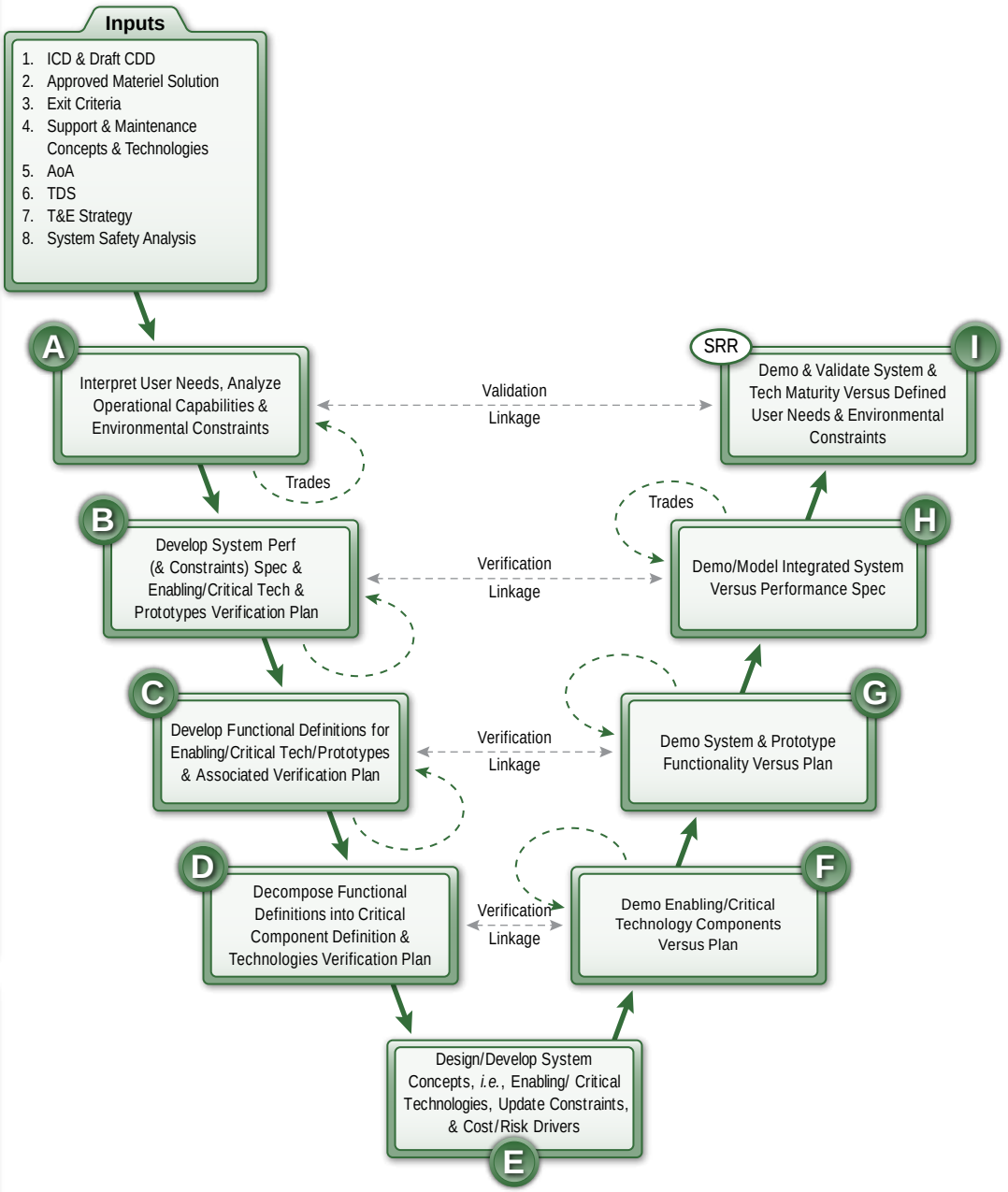
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Inputs)

Habitability

Activities for Each Input:

1.0 Collect and interpret data related to habitability and identify habitability constraints and performance attributes
2.0 Evaluate solution concept against habitability requirements
2.1 Ensure integration with other HSI domains
2.2 Provide habitability inputs to the mockup and modeling and simulation approaches
3.0 Develop habitability exit criteria
3.1 Provide Net Habitable Volume requirements (if applicable)
3.2 Ensure that habitability concepts in CONOPS and Support Concepts are refned and updated
4.0 Provide habitability inputs for maintenance facilities and activities
5.0 Provide habitability inputs to alternatives identifed in AoA and technologies identifed in TDS
6.0 Determine habitability verifcation methods (inspection, analysis, demonstration, or test)
7.0 Incorporate habitability risks in T&E Strategy
7.1 Incorporate requirements for habitability simulations, mockups, and test facilities
8.0 Identify habitability hazards and coordinate with safety POCs to provide inputs as required



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

References:

- DODI 5000.02
- DAG
- NASA-STD-3001 Vol II

Tools:

- NHV
- Index of Habitability
- IMPRINT
- CATIA
- JACK

Technology Development Phase (Inputs): Habitability

A
- Update habitability constraints
- Develop habitability criteria for: available space and privacy, egress, ergonomics, access to water and nutrition, hygiene, berthing, temperature and noise control, and support facilities
- Identify habitability technology needs

B
- Update habitability performance criteria
- Add habitability criteria to system and subsystem specifcations
- Formulate habitability verifcation and test criteria
- Ensure habitability is added to evaluation factors for solicitations and contract documents

C
- Update habitability subsystem criteria and continue to integrate with other HSI domains for inputs
- Develop habitability subsystem evaluation criteria

D
- Update habitability subsystem criteria and continue to integrate with other HSI domains for inputs
- Develop habitability subsystem evaluation criteria

E
- Update habitability subsystem criteria and continue to integrate with other HSI domains for inputs
- Develop habitability subsystem evaluation criteria

F
- Update survey of habitability critical technologies
- Verify/update risks related to critical technologies

G
- Update survey of habitability critical technologies
- Verify/update risks related to critical technologies

H
- Oversee habitability mockup and modeling and simulation activities
- Review habitability modeling outputs for hazards and risks

I
- Continue to evaluate habitability-critical technologies

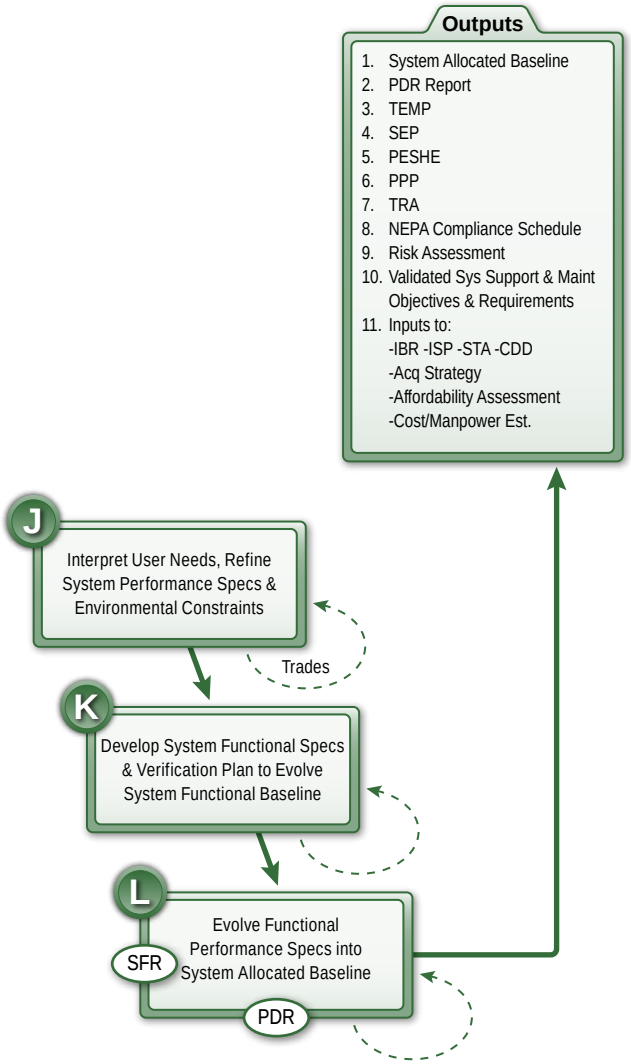
SRR
- Validate habitability criteria against user requirements
- Ensure measurable habitability requirements are clearly defned in the system performance specifcation
- Ensure all habitability performance requirements that affect system requirements derived from the CDD are testable and defned in the system functional baseline
- Ensure that habitability risks are included in the comprehensive risk assessment

Trades
- Coordinate with other HSI domains to assess trade-offs within HSI
- Ensure trade space and risks analyzed include habitability considerations and are assessed against available technologies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Technology Development Phase (Outputs)

Habitability



Activities for Each Output:

1.0 Provide habitability criteria for each CI
2.0 Provide habitability inputs
3.0 Determine habitability risk areas to make inputs to the TEMP
3.1 Determine verifcation criteria for the designated habitability risk areas
4.0 Ensure habitability processes, measurement tools, and roles for habitability specialists are defned in the HSIP section of the SEP
5.0 Provide habitability inputs
6.0 Provide inputs as required
7.0 Update technology readiness assessments for habitability technologies as required
8.0 Work with Environmental Engineers to coordinate habitability inputs to NEPA checklists
9.0 Provide habitability risks inputs
10.0 Provide habitability inputs to maintenance facilities planning and update habitability inputs as required
11.0 Update habitability inputs to integrated baseline
11.1 Provide habitability inputs to these documents as required
11.2 Update habitability inputs to CDD
11.3 Provide habitability inputs to life cycle cost estimates
11.4 Integrate habitability characteristics with manpower estimates
11.5 Review and provide updates to LCMP

References:

- DODI 5000.02 & DAG
- NASA-STD-3001 Vol II
- AFI 63-101

Tools:

- NHV
- Index of Habitability
- IMPRINT, CATIA, JACK
- Anthropometry measurements

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Technology Development Phase (Outputs): Habitability

J

- Update habitability constraints
- Develop habitability criteria for: available space and privacy, egress, ergonomics, access to water and nutrition, hygiene, berthing, temperature and noise control, and support facilities
- Identify habitability technology needs

K

- Update habitability performance criteria
- Provide habitability inputs to system functional performance requirements
- Develop habitability subsystem evaluation criteria
- Provide habitability updates for demilitarization/disposal planning if appropriate

L

- Update habitability subsystem criteria and continue to integrate with other HSI domains for inputs
- Develop habitability subsystem evaluation criteria
- Provide updated input for demilitarization/disposal planning as needed

SFR

- Ensure all habitability performance requirements that affect system requirements derived from the CDD have been addressed and are included in the system functional baseline

PDR

- Provide habitability inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifications
- Ensure habitability risks are identified and manageable

Trades

- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem habitability
- Refine habitability-related threshold and objective requirements as needed based on the results of completed trade studies

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

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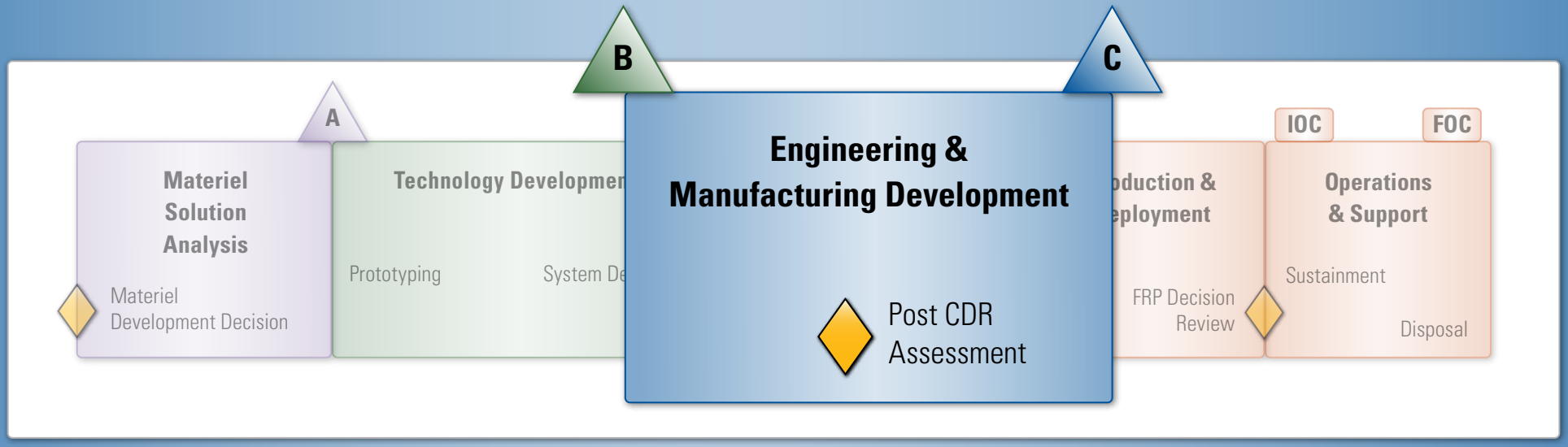
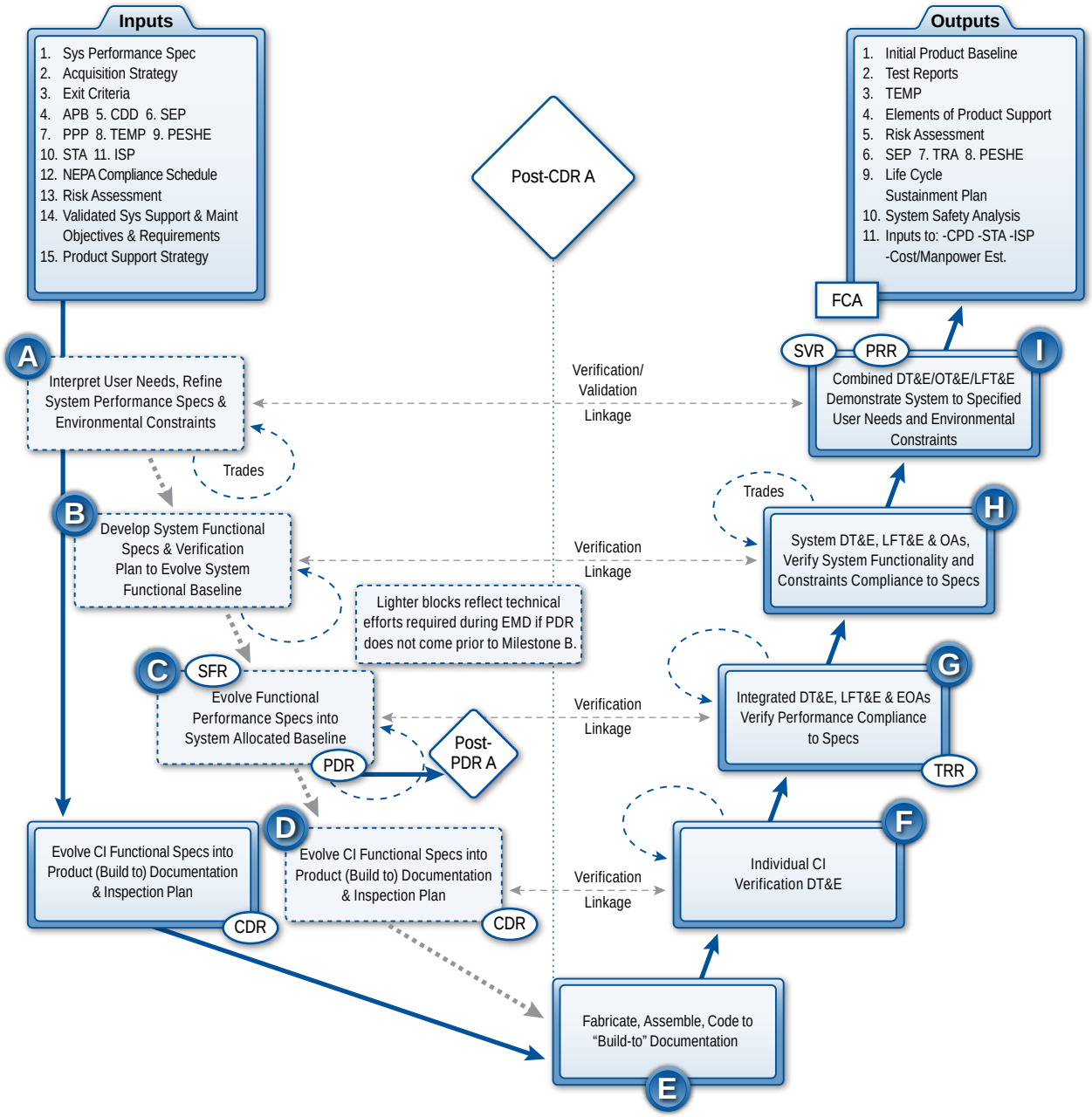


Engineering and Manufacturing Development—The purpose of the EMD Phase is to develop a system or an increment of capability; complete full system integration (technology risk reduction occurs during Technology Development); develop an affordable and executable manufacturing process; ensure operational supportability with particular attention to minimizing the logistics footprint; implement human systems integration (HSI); design for producibility; ensure affordability; protect CPI by implementing appropriate techniques such as anti-tamper; and demonstrate system integration, interoperability, safety, and utility. (DODI 5000.02)

<< Back

Engineering & Manufacturing Development

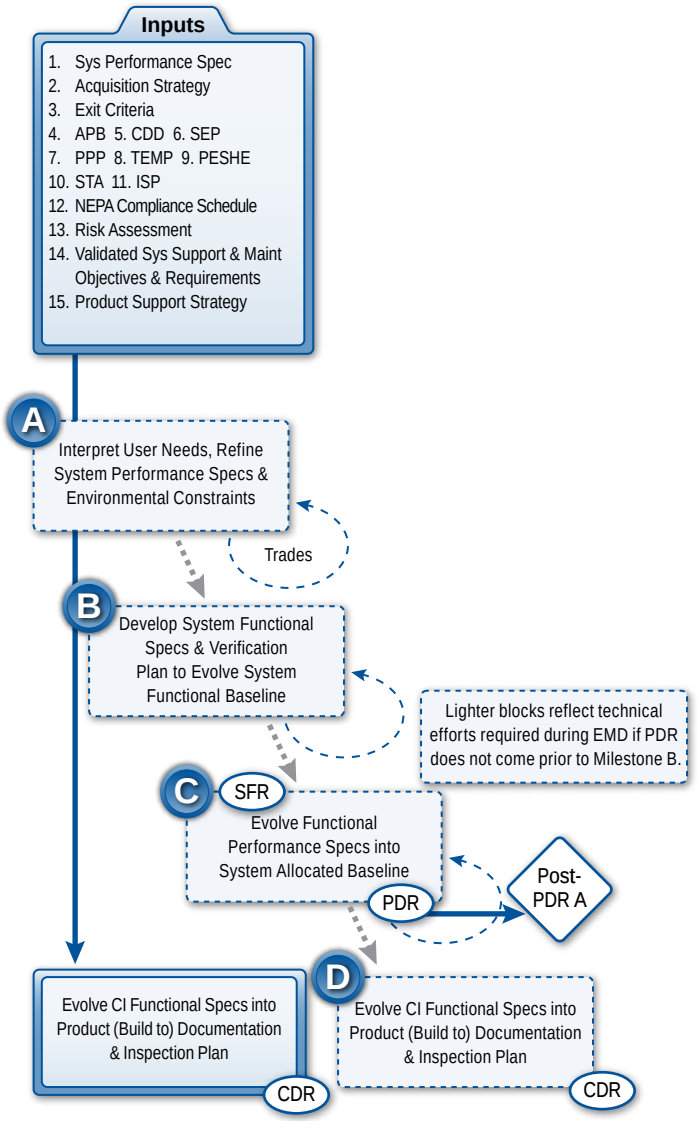


Engineering and Manufacturing Development (Inputs)

Human Systems Integration

Activities for Each Input:

1.0 Update HSI performance criteria
1.1 Ensure domain-specifc inputs are included
2.0 Provide HSI inputs as required
3.0 Update critical domain-specifc risks and mitigation approaches
4.0 Verify HSI criteria are included
5.0 Update HSI inputs
6.0 Validate and fnalize HSIP
6.1 Include HSI domain inputs
7.0 Provide HSI inputs as required
8.0 Assess HSI risk areas
8.1 Review modeling and simulation efforts and results
8.2 Develop and document Live Fire Test and Evaluation (LFT&E) strategy
9.0 Coordinate with ESOH Subject Matter Experts (SMEs) to verify HSI consideration
9.1 Review the Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE) and ensure it includes HSI integration strategy, risks, responsibilities, and hazard tracking process
10.0 Verify HSI content if required
11.0 Verify HSI content if required
12.0 Review NEPA schedule checklist items for HSI inputs as applicable
13.0 Update HSI risks based on new/recent tests and analysis
14.0 Provide consolidated HSI inputs to the support and maintenance requirements and associated plans
15.0 Provide HSI inputs as required



References:

- DODI 5000.02 & DODD 5000.01
- DAG
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- IMPRINT
- CATIA
- ATB Model
- IPME

Engineering and Manufacturing Development (Inputs): Human Systems Integration

A

- Develop HSI profle and system boundaries across the life cycle
- Embed HSI in requirements and acquisition documentation *i.e.,* ICD, CDD, APB, SEP, HSIP, TEMP, LCMP
- Identify and/or develop HSI-critical requirements and verify they are included in the requirements tracking system
- Include ESOH assessment (reference updated DAG, Chapter 4–Systems Engineering)

B

- Initiate development of HSI analysis and risk metrics
- Review and understand all subsystem HMI and HSI requirements
- Review all trade studies for HSI impacts
- Expand HSI analysis to include functional specifcations
- Verify HSI-critical functional specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Verify NEPA/EO 12114 requirements are being met at proposed testing and training locations
- Provide updated input for demilitarization/disposal planning

C

- Review updated system safety and ESOH hazard and risk analysis for HSI impacts (*e.g.,* PHA, SHA, SSHA, and O&SHA)
- Review HSI-derived requirements for component, subsystem, and system to include test requirements
- Provide updated input for demilitarization/disposal planning
- Expand and update HSI limitations, risks, and attributes as detailed design specifcations evolve
- Verify HSI-critical design specifcations are included in requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan
- Ensure HSI is addressed as part of the overall PDR

D

- Review ESOH hazard and risk analysis for HSI impacts (*e.g.,* SSHA, SHA, and O&SHA)
- Update HSI-derived requirements for component, subsystem, and system to include test and inspection requirements
- Identify HSI-critical processes for product baseline build-to documentation and software code-to documentation
- Include system HSI-critical processes and components in inspection plan
- Participate in component design selections
- Review Level of Repair Analysis and Maintenance Task Analysis for HSI impacts
- Verify system HSI-critical design specifcations are included in the requirements tracking system and detailed design specifcations as necessary

SFR

- Ensure HSI requirements are addressed in the system functional baseline in conjunction with the lower-level performance requirements
- Incorporate HSI in system and software assessments
- Ensure requirements, metrics, and development efforts associated with HSI are included in the program documentation and LCMP
- Ensure system requirements and the functional baseline are suffciently detailed to enable a reasonable cost estimate

PDR

- Ensure domain performance requirements are included in the preliminary design
- Review subsystem requirements to address HSI issues from all functional areas
- Ensure HSI design factors have been reviewed and included where needed in the overall system design
- Ensure HSI risks are identifed and manageable
- Ensure 100% of all safety-critical drawings are complete.
- Ensure requirements, metrics, and development efforts associated with HSI are included in the program documentation and LCMP
- Evaluate the preliminary design for possible risks, design shortfalls and undocumented requirements

CDR

- Update HSI inputs in the risk assessment
- Review CDD requirements to ensure HSI concerns are considered
- Ensure HSI risks are identifed and manageable
- Ensure requirements, metrics, and development efforts associated with HSI are included in the program documentation and LCMP
- Ensure hardware design and software product specifcations have adequately addressed all HSI risks

Trades

- Participate in HSI-critical trade studies and review results of all trade studies
- Ensure as the design is fnalized, HSI considerations that affect the component level of the system are part of the decision making and trade studies that occur at this level of design
- Coordinate with other HSI domains to assess trade-offs within HSI and determine technology readiness
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem HSI requirements

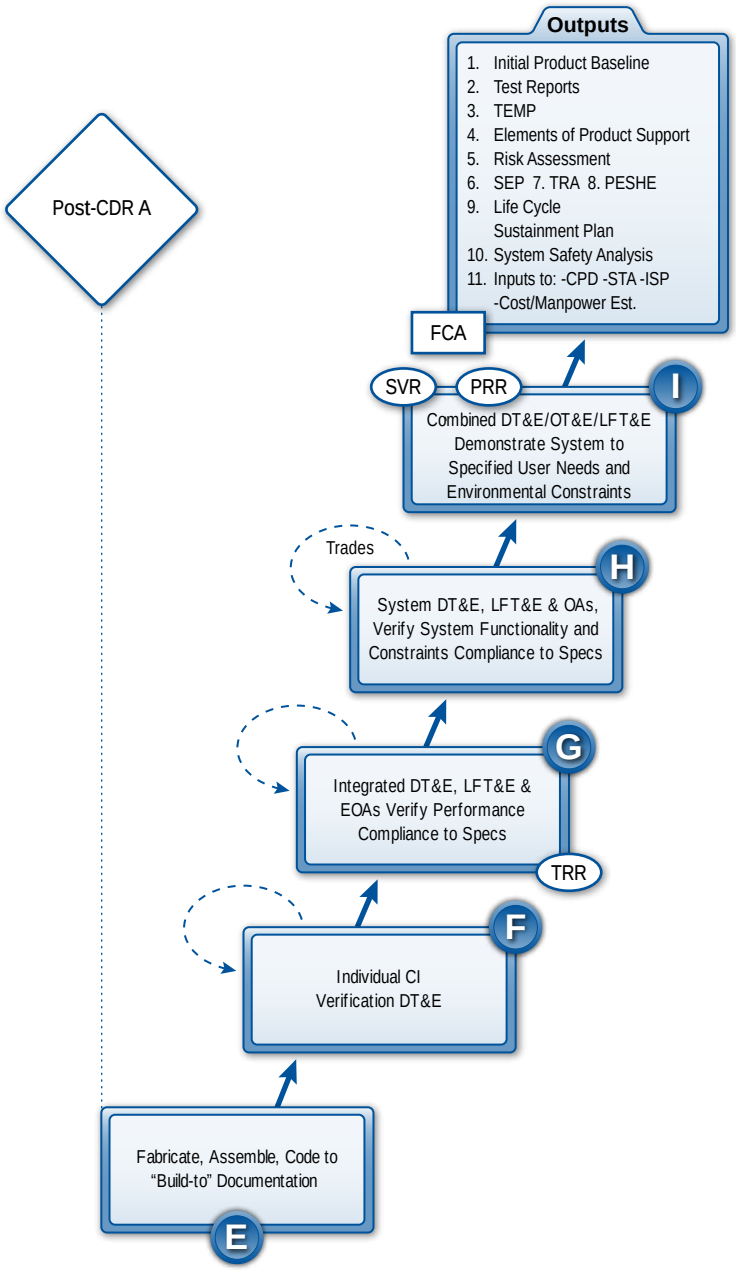
Post-PDR A

- Ensure open HSI issues and risks are documented in the PDR assessment report
- Review documentation for domain-specifc requirements, analysis, decisions, and taskings

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering and Manufacturing Development (Outputs)

Human Systems Integration



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Update domain considerations into baseline parameters and reassess domain performance requirements
1.2 Integrate subsystem and component requirements
2.0 Identify HSI concerns in modeling and simulation outputs, mock-up tests, and frst article testing
3.0 Review and update for HSI issues
4.0 Identify HSI aspects of maintenance and logistics
5.0 Document residual risks and HSI risk acceptance decisions
5.1 Review domain-specifc incidents and mishaps that are HSI-related
6.0 Update HSIP with HSI-related concerns from technical reviews
6.1 Update strategy to refect HSI risks and control measures
7.0 Update HSI technology readiness levels from risk considerations
8.0 Identify ESOH risks and strategy for integration into SEP and HSIP
8.1 Review identifed gaps with ESOH POCs
9.0 Update HSI inputs to maintenance and logistics planning
10.0 Review System Safety Analysis for accuracy and completeness
10.1 Review safety analysis data for HSI opportunities
11.0 Provide HSI inputs as required
11.1 Update the MER with HSI-relevant content

References:

- DODI 5000.02 & DODD 5000.01
- DAG
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

Tools:

- IMPRINT
- CATIA
- ATB Model
- IPME

Engineering and Manufacturing Development (Outputs): Human Systems Integration

E

- Evaluate process and design changes as necessary
- Review and recommend HSI updates to the TEMP
- Ensure CI verifcation Developmental Test and Evaluation (DT&E) procedures include HSI requirements and verifcation testing
- Initiate HSI risk acceptance reviews and documentation as appropriate

F

- Update status information on HSI risks and impacts
- Verify integrated DT&E, LFT&E, and Early Operational Assessment (EOA) procedures include appropriate HSI tests and evaluations
- Recommend HSI risk mitigation control measures based on DT&E test results as appropriate
- Initiate HSI risk acceptance reviews and documentation as appropriate
- Ensure NEPA/EO 12114 compliance is completed prior to testing

G

- Ensure tests are conducted that address HSI and all test results are reviewed for hazard control effectiveness
- Update HSI impacts and risks based upon confguration changes
- Provide updated HSI input for demilitarization/disposal planning
- Verify system DT&E, LFT&E and EOA procedures include HSI-appropriate tests
- Recommend HSI risk mitigation measures based on test results
- Provide HSI risk review and acceptance for upcoming test activities, as appropriate
- Verify that HSI test results support specifcation requirements

H

- Ensure NEPA/EO 12114 compliance is completed prior to testing
- Ensure test results mitigated HSI-relevant challenges
- Update HSI status and analyses based upon confguration changes
- Verify the combined DT&E, LFT&E and EOA procedures include appropriate HSI tests derived from system HSI analyses and reviews
- Recommend HSI risk mitigation measures as necessary
- Provide HSI risk review and acceptance for upcoming test activities as appropriate
- Ensure HSI issues identifed during testing are resolved

I

- Ensure NEPA/EO 12114 compliance is completed prior to testing
- Ensure test results mitigated HSI-relevant challenges
- Review operational supportability and interoperability certifcations for HSI suffciency
- Identify and characterize any residual HSI risks
- Update HSI status and analyses based upon confguration changes
- Recommend HSI risk mitigation measures, as necessary

TRR

- Ensure tests are planned to address identifed HSI requirements
- Ensure test procedures and planning are complete and compliant for HSI
- Verify that identifed HSI risk levels are acceptable to the program leadership
- Ensure operations and support HSI risks are fully documented and made available to testers

SVR

- Ensure system functionality is assessed and determine if it meets HSI requirements documented in the functional baseline
- Ensure adequate HSI metrics are in place
- Ensure HSI risks are identifed and manageable
- Review manufacturing processes to ensure the manufacturer has addressed HSI issues, focusing on environment, safety, packaging, and transportation
- Reassess production readiness in the event of signifcant manufacturing process changes (*i.e.,* new locations or subcontractors)

PRR

- Ensure HSI risks are identifed and manageable
- Ensure changes made during Engineering and Manufacturing Development do not degrade HSI in either the materials or manufacturing processes

FCA

- Confrm the HSI performance requirements achieve their functions during testing
- Ensure HSI concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specifcation is met
- Audit HSI functional requirements against development test results to ensure satisfaction of all requirements

Trades

- Ensure as the design is fnalized, HSI considerations that affect the component level of the system are part of the decision making and trade studies that occur at this level of design
- Participate in HSI-critical trade studies to ensure HSI concerns are addressed
- Review results of all trade studies

Post-CDR A

- Assess HSI risks against exit criteria for this acquisition phase
- Identify those HSI risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

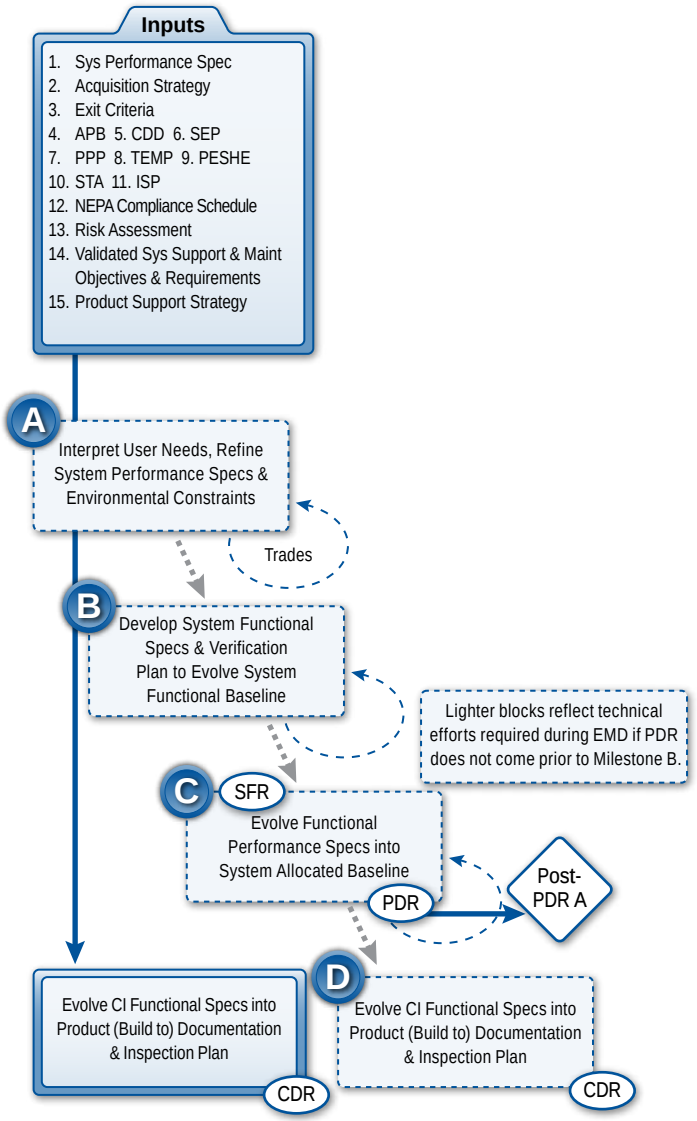
Manpower

Activities for Each Input:

1.0 Identify manpower system performance specifcations
2.0 Provide inputs as needed
3.0 Develop manpower exit criteria
4.0 Refne the initial manpower estimates
5.0 Update the initial MER
6.0 Identify trade-offs
7.0 Provide inputs as needed
8.0 Incorporate manpower drivers into the TEMP
8.1 Assess manpower impact
9.0 Continue to review the PESHE and assess any manpower impacts
9.1 Identify potential manpower drivers
10.0 Provide inputs as needed
11.0 Identify support manpower requirements
12.0 Continue to review and provide inputs as needed
13.0 Assess and document risk of AF inability to meet manpower requirements
13.1 Incorporate any identifed manpower risks
14.0 Identify and incorporate manpower requirements for system operations, maintenance, and support
14.1 Provide or assist with analysis of organic versus contractor logistics support
15.0 Assess support manpower requirements

References:

- AFI 38-201
- AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101
- AFMAN 63-119, Atch 9
- T.O. 00-35D-54



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- AFMSs
- LCOM, CHRIS, MPES
- TDFA, TSSA
- Manpower Typicals

Engineering and Manufacturing Development (Inputs): Manpower

A

- Review system performance specifcations
- Develop an initial process-oriented description for tasks associated with operating, maintaining, and supporting the system
- Identify the manpower standards impacted by these tasks and use them to estimate manpower requirements

B

- Identify manpower costs/exit criteria for system performance
- Estimate manpower costs for different system specifcations
- Provide trade-off assessments of manpower costs
- Task potential user commands for manpower inputs
- Update the manpower category mix (offcer, enlisted, civilian or contractor)
- Prepare program objective memorandum input
- Update the manpower input for demilitarization/disposal planning

C

- Adjust manpower impacts with each evolution of functional specifcations
- Assess and revise manpower requirements as needed following test and evaluation exercises
- Identify manpower costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted manpower estimates as needed
- Update the manpower input for demilitarization/disposal planning

D

- Review system performance specifcations
- Refne the initial process-oriented description for tasks associated with operating, maintaining, and supporting the system
- Revise the MER to refect current manpower estimates
- Ensure POM and manpower allocation actions are in synchronization with the build schedule

SFR

- Present manpower-critical requirements, costs, and risk status at SFR
- Ensure all manpower performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Ensure manpower costs are included in the LCCE and the MER
- Provide manpower inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Ensure manpower risks are identifed and manageable

CDR

- Ensure manpower costs are included in the LCCE and the MER
- Ensure manpower requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure manpower issues have been addressed
- Ensure manpower risk areas have been addressed as required

Trades

- Participate in trade studies to evaluate options against manpower costs throughout this phase to ensure manpower concerns are addressed
- Coordinate with other HSI domains to assess trade-offs with HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem manpower requirements

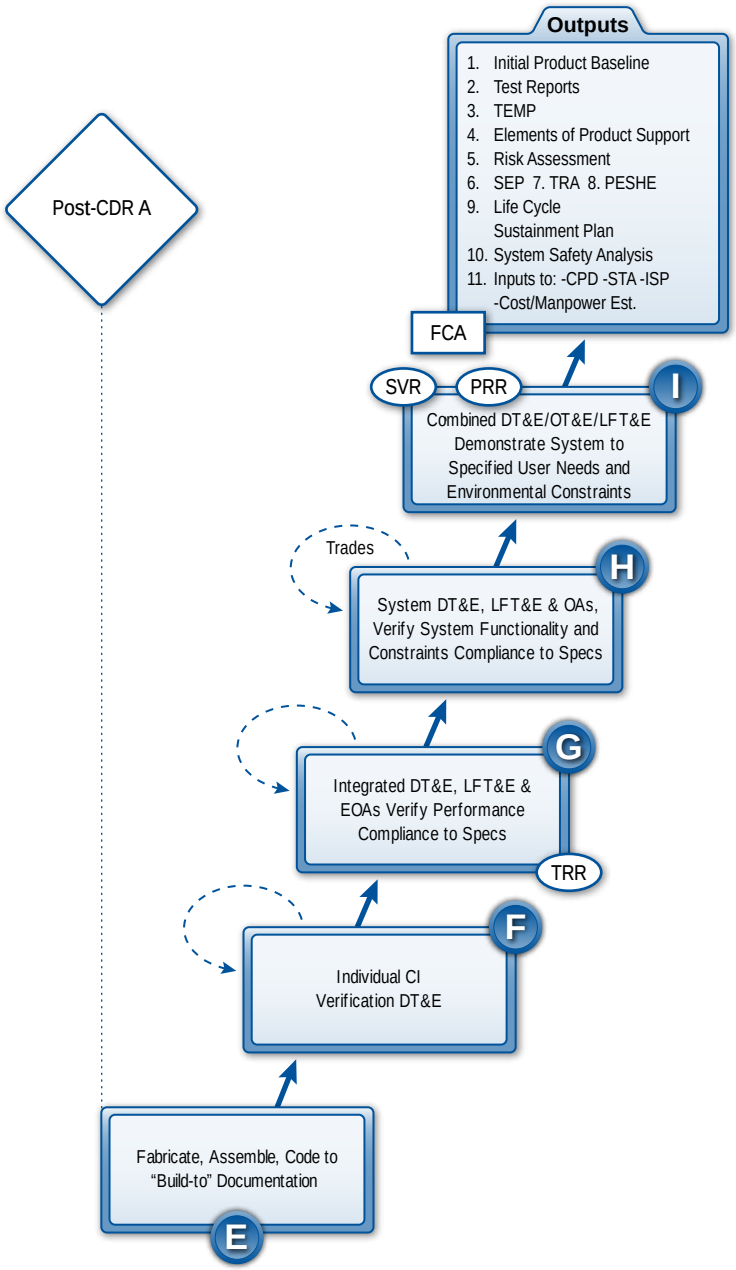
Post-PDR A

- Ensure manpower costs are included in the LCCE and the MER

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Manpower



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Assess the baseline and POM for manpower requirements
1.1 Estimate manpower costs for system location options
2.0 Assess manpower impacts
3.0 Assess manpower impacts
4.0 Calculate support manpower costs
4.1 Consolidate MER inputs from user commands
5.0 Update potential manpower risks
6.0 Identify trade-offs
7.0 Identify manpower funding issues
8.0 Assess manpower impacts
9.0 Estimate manpower costs and incorporate in the MER
10.0 Identify safety related manpower drivers
11.0 Assess manpower impact of inputs from other domains and adjust manpower cost estimates as needed
11.1 Review and provide inputs to the LCMP

References:

- AFI 38-201
- AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101
- AFMAN 63-119, Atch 9
- T.O. 00-35D-54

Tools:

- Discrete Event Simulation
- Micro Saint Sharp
- Job, Task, Function/Workload Analysis
- AFMSs
- LCOM, CHRIS, MPES
- TDFA, TSSA
- Manpower Typicals

Engineering and Manufacturing Development (Outputs): Manpower

E

- Evaluate process and design changes as necessary for manpower impacts
- Refne initial process-oriented description

F

- Assess the interface design for labor-intensive, high manpower driver tasks
- Evaluate and price out options for reducing the high manpower driver tasks
- Determine crew ratio requirements and staffng patterns
- Refne manpower category mix (offcer, enlisted, civilian or contractor)
- Refne POM input to refect system design changes
- Evaluate DRs for manpower implications
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Adjust manpower impacts with each evolution of functional specifcations
- Assess and revise manpower requirements as needed following test and evaluation exercises
- Identify manpower costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted manpower estimates as needed
- Participate in DR boards for manpower implications
- Update the manpower input for demilitarization/disposal planning

H

- Review system performance specifcations
- Refne the initial process-oriented description for tasks associated with operating, maintaining, and supporting the system
- Continue to participate in DR boards for manpower implications
- Participate in Site Activation Task Forces (SATAFs) to assess manpower impacts

I

- Assess the Training Pipeline Requirements (TPR) and Student Trained Requirement (STR)
- POM for TPR/STR
- Compare projected production schedule with POM inputs and ensure manpower funding is synchronized with deployment plans for the new system
- Continue to participate in DR boards for manpower implications
- Continue to participate in SATAFs to assess manpower impacts

TRR

- Review testing confguration and identify any manpower issues

SVR

- Present manpower-critical requirements, costs, and risk status
- When system functionality is assessed, verify that manpower requirements and constraints, as documented in the functional baseline, have been suffciently addressed
- Ensure manpower risks are identifed and manageable, and that appropriate metrics associated with manpower are in place

PRR

- Verify manpower funding is synchronized with production schedule personnel assignment process, and training quotas
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade manpower-related performance

FCA

- Ensure manpower costs are included in the LCCE and the MER
- Review functional confguration and identify any manpower issues
- Ensure manpower concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specifcation is met

Trades

- Participate in trade studies to evaluate options against manpower costs throughout this phase to ensure manpower concerns are addressed

Post-CDR A

- Assess manpower risks against exit criteria for this acquisition phase
- Identify those manpower risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

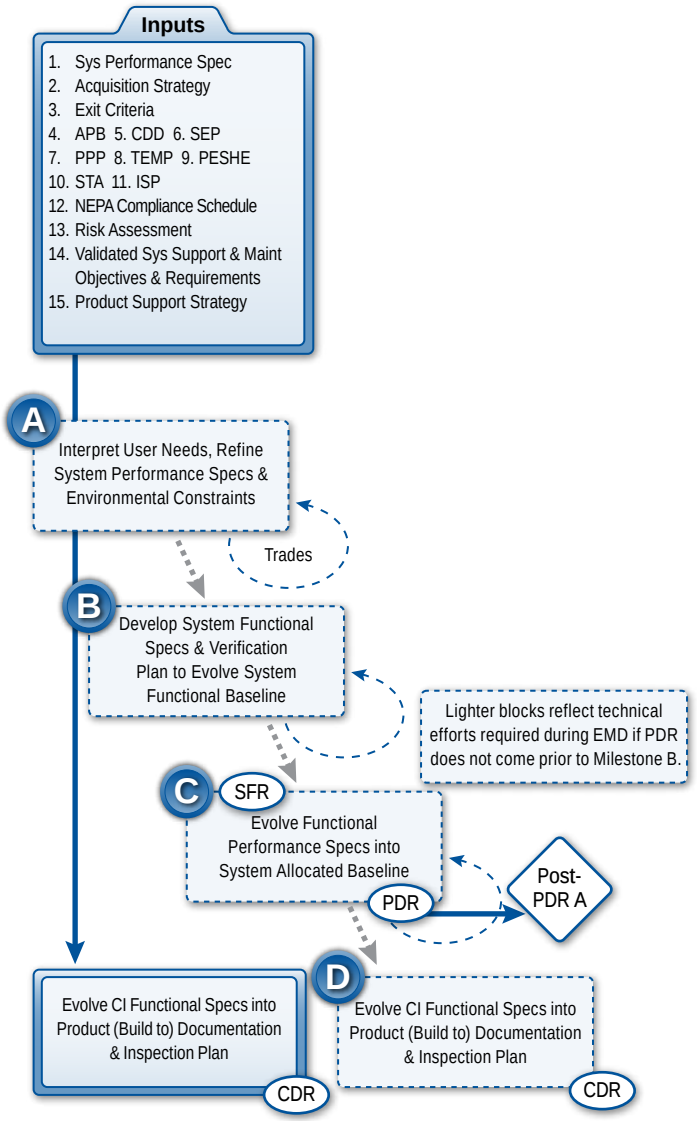
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Personnel

Activities for Each Input:

1.0 Review the BCS and identify personnel series and AFSCs required to operate, maintain, and support the system
2.0 Assess associated personnel impacts and costs
3.0 Determine realistic personnel goals and constraints
3.1 Ensure a personnel needs analysis is developed and approved
4.0 Provide a personnel input to the manpower estimates
5.0 Review and assess for potential personnel impacts
6.0 Provide inputs as needed
7.0 Provide inputs as needed
8.0 Incorporate personnel drivers into the TEMP
8.1 Review and assess for potential personnel impacts
9.0 Continue to review the PESHE and assess any personnel impacts
10.0 Provide inputs as needed
11.0 Identify needed personnel support skills (AFSCs, series, *etc.*)
12.0 Review and assess for potential personnel impacts
13.0 Incorporate any identifed personnel risks
14.0 Identify operations and support AFSC and skill requirements
14.1 Support analysis of organic versus contractor logistics support
15.0 Assess support personnel requirements
15.1 Ensure system support plans document all required AFSCs and skill-levels



References:

- AFI 63-101 & AFMAN 63-119, Atch 9
- AFPD 36-14
- AFPD 36-21 & AFPD 36-22
- AFI 36-3802 & AFI 36-2623
- AFI 36-2305
- AFI 36-2101 & AFI 36-2110
- T.O. 00-35D-54

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect

Engineering and Manufacturing Development (Inputs): Personnel

A

- Review system performance specifcations
- Develop an initial personnel description for tasks associated with operating, maintaining, and supporting the system
- Identify the classifcation series and AFSCs impacted by these tasks

B

- Identify personnel costs/exit criteria for system performance
- Estimate personnel costs for different system specifcations
- Provide trade-off assessments of personnel costs
- Task potential user commands for personnel inputs, especially AFSCs, series, grades, and special experience/education
- Refne the TAD and determine what skill code mix will be needed to operate and maintain the system
- Prepare/review POM inputs

C

- Adjust personnel impacts with each evolution of functional specifcations
- Assess and revise personnel requirements as needed following test and evaluation exercises
- Identify personnel impacts associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted personnel estimates as needed

D

- Review system performance specifcations
- Refne the initial TAD based on tasks associated with operating, maintaining, and supporting the system
- Review recruiting and assignment projections for synchronization with build schedule and operating locations, if known

SFR

- Evaluate personnel-critical requirements, costs, and risk status as presented at SFR
- Note any discrepancies and issue action items as appropriate at SFR
- Assess the approved product support plan for consistency with SFR data products
- Ensure all personnel performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Ensure personnel series and grade assumptions and personnel costs are documented in the LCCE and the MER
- Assess the approved product support plan and updates for consistency with PDR data products
- Provide personnel inputs to the assessment of the system and subsystem preliminary design as captured in the confguration item specifcations
- Ensure personnel risks are identifed and manageable

CDR

- Ensure personnel series and grade assumptions and personnel costs are documented in the LCCE and the MER
- Assess approved product support plan and updates for consistency with CDR data products
- Ensure personnel risk areas have been addressed as required
- Ensure personnel requirements and constraints have been addressed in the product specifcations for each confguration item
- Review design documentation as required to ensure personnel issues have been addressed

Trades

- Participate in trade studies to evaluate options against identifed personnel criteria throughout this phase to ensure personnel concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem personnel requirements

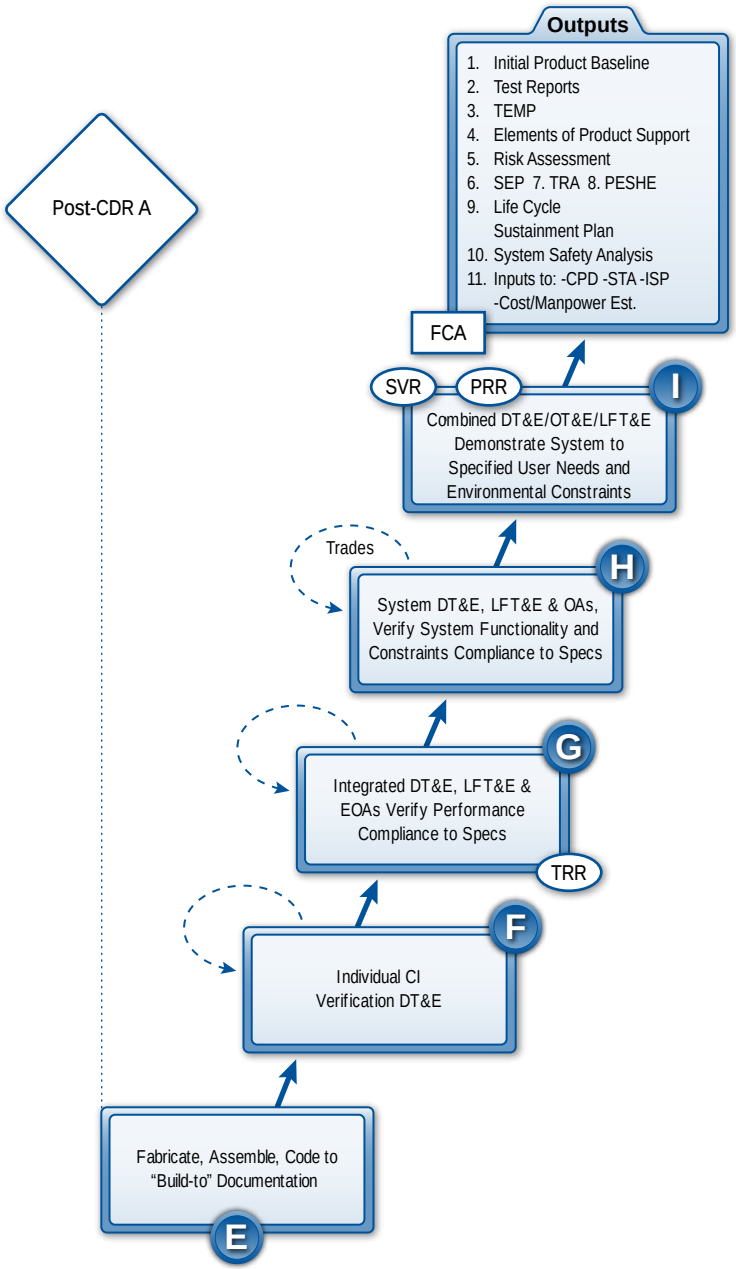
Post-PDR A

- Ensure personnel series and grade assumptions and personnel costs are documented in the LCCE and the MER
- Ensure personnel risks are adequately described in the Post-PDR A report

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Personnel



Activities for Each Output:

1.0 Prepare an assignment schedule for training and system operations and support synchronized with the production schedule
2.0 Review and assess for personnel issues
3.0 Review and assess for personnel issues
4.0 Refne target audience description
5.0 Determine any personnel risks
6.0 Identify trade-offs
7.0 Determine any personnel risks
8.0 Review and assess for personnel impacts
9.0 Review LCMP and assess for personnel issues
10.0 Identify safety-related personnel drivers
11.0 Ensure user MAJCOMs provide personnel inputs for the MER
11.1 Consolidate personnel MER inputs and work with manpower POCs to ensure inclusion in the fnal MER
11.2 Ensure POM inputs include personnel requirements
11.3 Evaluate each of these documents for personnel impacts

References:

- AFI 63-101 & AFMAN 63-119, Atch 9
- AFPD 36-14
- AFPD 36-21 & AFPD 36-22
- AFI 36-3802 & AFI 36-2623
- AFI 36-2305
- AFI 36-2101 & AFI 36-2110
- T.O. 00-35D-54

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Engineering and Manufacturing Development (Outputs): Personnel

E

- Evaluate process and design changes for personnel impacts
- Refne initial series and AFSC descriptions of the target audience

F

- Assess the interface designs for personnel issues
- Evaluate and estimate options for reducing the high personnel drivers
- Review crew ratio and staffng requirements
- Refne personnel assignment mix
- Refne POM input to refect system design changes
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Review and adjust personnel impacts as needed with each evolution of functional specifcations
- Assess and revise personnel requirements as needed following test and evaluation events
- Identify personnel costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted personnel issues as needed
- Participate in DR boards for personnel implications

H

- Review system performance specifcations
- Refne the TAD for tasks associated with operating, maintaining, and supporting the system
- Participate in SATAFs to assess personnel impacts
- Continue to participate in DR boards for personnel implications

I

- Assess TPR/STR
- POM for TPR/STR
- Compare projected production schedule with POM inputs and ensure personnel assignments are synchronized with deployment plans for the new system
- Continue to participate in DR boards for personnel implications

TRR

- Review testing confguration and identify any personnel issues
- Coordinate AFSC, series, and special experience/education baselines with the Air Force Operational Test and Evaluation Center (AFOTEC)

SVR

- Evaluate personnel-critical requirements, costs, and risk status as presented at SVR
- Ensure personnel risks are identifed and manageable, and that appropriate metrics associated with personnel are in place
- When system functionality is assessed, verify that personnel requirements and constraints, as documented in the functional baseline, have been suffciently addressed

PRR

- Verify personnel assignments funding is synchronized with the production schedule, personnel assignment process, and training quotas
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade personnel-related performance

FCA

- Ensure personnel costs are factored into the LCCE and the MER
- Validate and update the CARD
- Review functional confguration and identify any personnel issues
- Ensure personnel concerns are addressed when reviewing the confguration item's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specifcation is met

Trades

- Participate in trade studies to evaluate options against identifed personnel criteria throughout this phase to ensure personnel concerns are addressed

Post-CDR A

- Assess personnel risks against exit criteria for this acquisition phase
- Identify those personnel risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

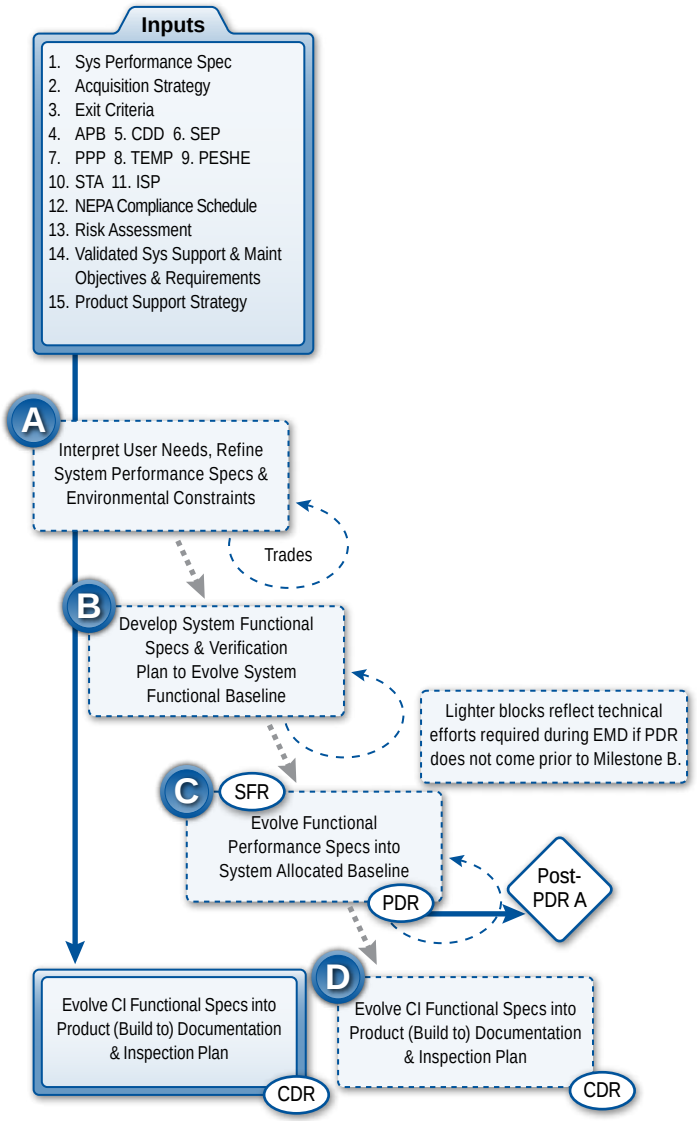
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Training

Activities for Each Input:

1.0 Review system performance specifcations
1.1 Develop a system performance task list
2.0 Determine realistic training goals and constraints
3.0 Use training constraints and costs to identify appropriate exit criteria
4.0 Review the baseline and anticipate future training costs
5.0 Provide training strategy inputs
6.0 Refne the initial training plan
7.0 Provide inputs as needed
8.0 Incorporate training drivers within T&E planning
8.1 Refne the system task list based on procedures in the TEMP
9.0 Continue to review the PESHE and assess any training impacts
10.0 Provide inputs as needed
11.0 Assess training support options and costs to include trainers/simulators
12.0 Continue to review and provide inputs as needed
13.0 Incorporate any identifed training risks
14.0 Incorporate training requirements for system support and maintenance
14.1 Develop recommendations for government versus contractor training
15.0 Evaluate options for government versus contractor training



References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3
- AFMAN 36-2234 & AFPD 36-22
- AFI 63-101 & AFMAN 63-119
- T.O. 00-35D-54

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- ADVISOR
- AIM
- HPAT
- VESARS

Engineering and Manufacturing Development (Inputs): Training

A

- Review system performance specifications
- Develop an initial BCS task description for tasks associated with operating, maintaining, and supporting the system
- Identify the impacted tasks for the new system and use them to estimate training requirements

B

- Identify training costs/exit criteria for system performance
- Estimate training costs for different system specifications
- Provide trade-off assessments of differing training options and costs
- Task potential user commands for training inputs
- Determine training type mix (classroom, on-line, *etc.*)
- Prepare POM TPR/STR input

C

- Adjust training impacts with each evolution of functional specifications
- Assess and revise training requirements as needed following T&E exercises
- Identify training issues and costs associated with safety and environmental compliance requirements
- Advise potential user commands of functional specifcation changes and collect adjusted training inputs as needed

D

- Review system performance specifications
- Refne the initial description of tasks associated with operating, maintaining, and supporting the system
- Provide a revised input to the MER and TPR/STR to refect current training estimates
- Ensure training development actions are in synchronization with the build schedule

SFR

- Present critical training requirements, costs, and risk status at SFR
- Ensure all training performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Ensure training costs are included in the LCCE and the MER
- Review product specifcations for training considerations
- Provide training inputs to the assessment of the system and subsystem preliminary design as captured in the confguration item specifcations
- Ensure training risks are identifed and manageable

CDR

- Ensure manpower costs are included in the LCCE and the MER
- Review product specifcations for training considerations
- Ensure training requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure training issues have been addressed
- Ensure training risk areas have been addressed as required

Trades

- Participate in trade studies to evaluate options against training costs throughout this phase to ensure training concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem training requirements

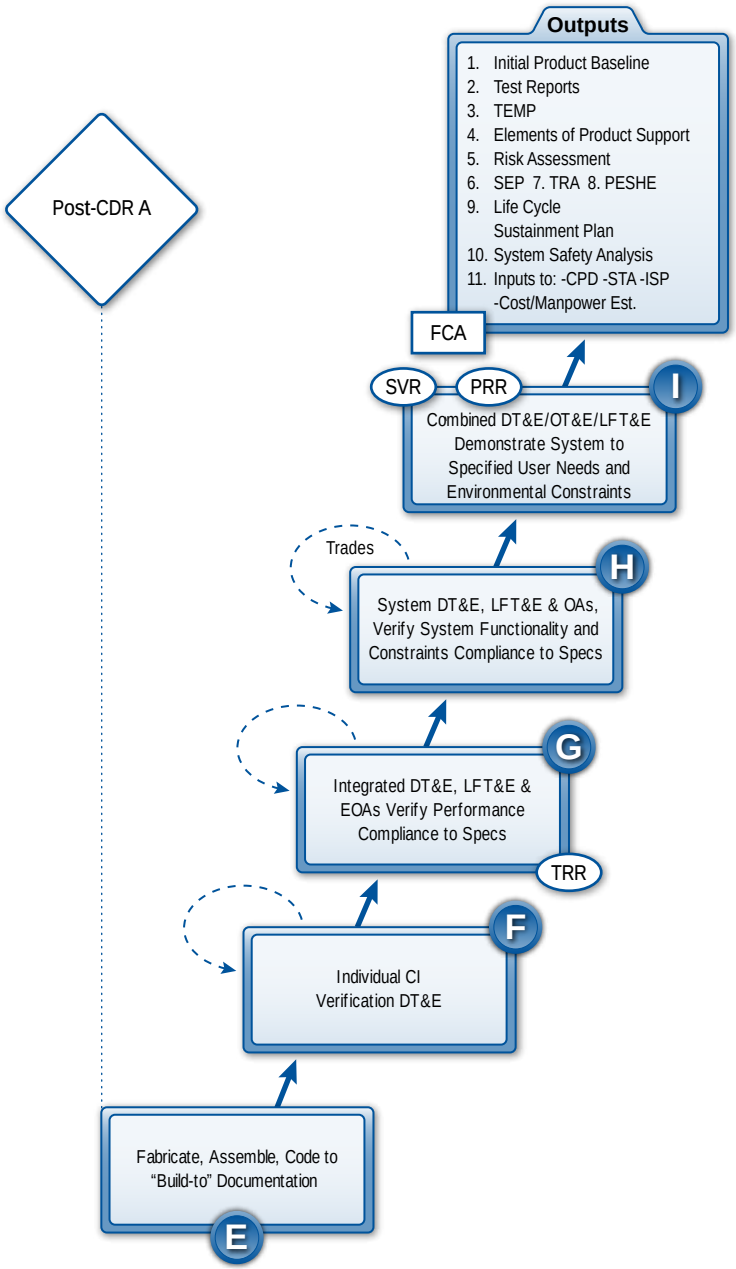
Post-PDR A

- Ensure training costs are in the LCCE and the MER

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Training



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Review the baseline and assess the readiness of training materials and courses
1.1 Ensure training schedules are synchronized with the production baseline
2.0 Review the reports and assess any issues that indicate additional training may be required
2.1 Revise training material as needed in response to design changes arising from test fndings
3.0 Review the TEMP and prepare a task list for the operational tasks being tested
3.1 Include scenarios to test training materials if possible
4.0 Review and assess potential training impacts
5.0 Assess and document potential risks if training requirements are not or cannot be met
6.0 Identify training responsibilities for integration into SE
7.0 Summarize potential training risks and mitigation options
8.0 Provide inputs as needed
9.0 Review and update LCMP inputs
9.1 Determine if training will be provided with organic or contractor personnel or both
10.0 Review and assess potential training impacts
11.0 Assess training support options and costs, to include trainers/ simulators
11.1 Review cost and manpower estimates for schoolhouse and training pipeline support

References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3
- AFMAN 36-2234 & AFPD 36-22
- AFI 63-101 & AFMAN 63-119
- T.O. 00-35D-54

Tools:

- HPAT
- ADVISOR
- AIM

Engineering and Manufacturing Development (Outputs): Training

E

- Refne estimates of training resources for the new system
- Assess ability to have adequate resources in schoolhouse and training pipeline to support system upon felding
- Evaluate readiness of any new/renovated training support physical facilities

F

- Review task lists for training alternatives
- Refne the training system plan
- Continue to assess ability to have adequate resources in schoolhouse and training pipeline to support system upon felding
- Continue to evaluate readiness of any new/renovated training support physical facilities
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Ensure preliminary course materials are available for DT&E and EOA activities
- Validate course materials *via* DT&E and EOA activities
- Continue to assess ability to have adequate resources in schoolhouse and training pipeline to support system upon felding
- Continue to evaluate readiness of any new/renovated training support physical facilities
- Participate in DR boards for training implications

H

- Conduct training effectiveness analysis
- Refne course materials
- Participate in site surveys and site activation activities if appropriate for beddown of a new weapon system and/or new training facilities
- Continue to assess ability to have adequate resources in schoolhouse and training pipeline to support system upon felding
- Continue to evaluate readiness of any new/renovated training support physical facilities
- Continue to participate in DR boards for training implications

I

- Refne training analysis based on maturing manpower estimates
- Test training materials
- Continue to assess ability to have adequate resources in schoolhouse and training pipeline to support system upon felding
- Continue to evaluate readiness of any new/renovated training support physical facilities
- Continue to participate in DR boards for training implications

TRR

- Review test plans and identify any training issues

SVR

- Ensure training risks have been identifed and addressed including if there will be adequate resources in the schoolhouse and training pipeline to support the system upon felding
- Ensure identifed training risks are manageable and that appropriate metrics associated with training are in place
- Verify training requirements and constraints, as documented in the functional baseline, have been suffciently addressed as part of the system functionality assessment

PRR

- Review production schedules and ensure training schedules are synchronized
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade training-related performance

FCA

- Review functional confguration and identify any training issues
- Ensure training concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specifcation is met

Trades

- Participate in trade studies to evaluate options against training costs throughout this phase to ensure training concerns are addressed

Post-CDR A

- Assess training risks against exit criteria for this acquisition phase
- Identify those training risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

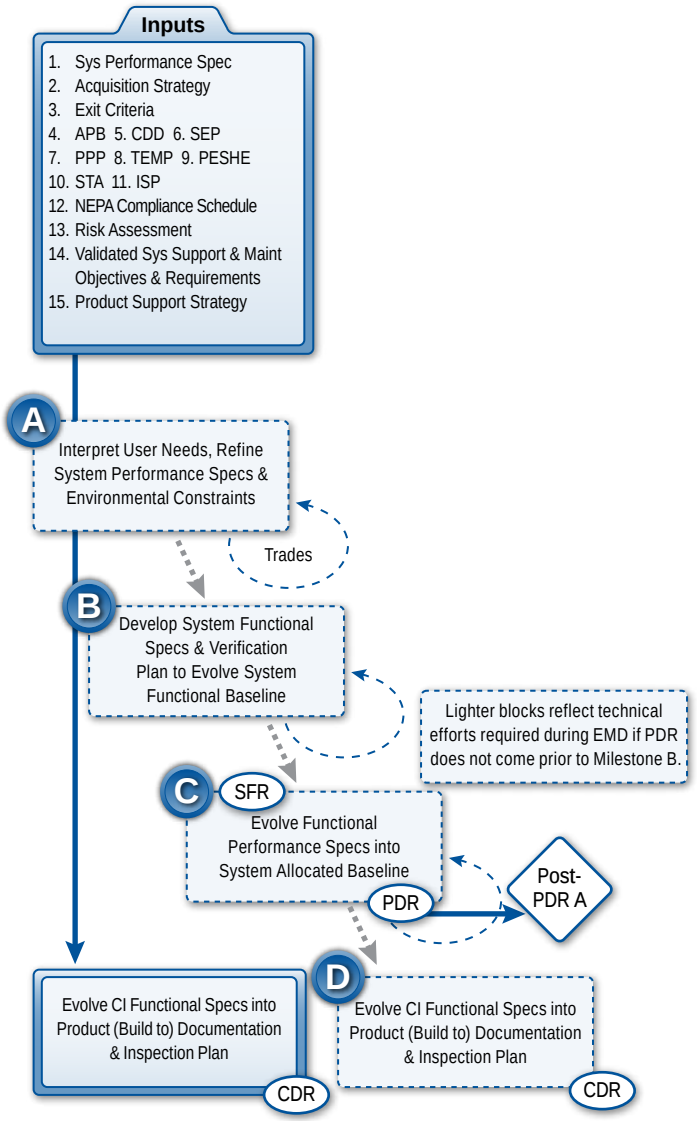
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Human Factors Engineering

Activities for Each Input:

1.0 Include results from mockups or modeling trials
2.0 Develop HFE exit criteria
3.0 Ensure HFE inputs are included in the system support and maintenance requirements
3.1 Ensure HFE inputs are included in exit criteria
4.0 Verify HFE inputs are included as required
5.0 Review HFE inputs to CDD
5.1 Identify ergonomic and interface technology requirements
6.0 Update HFE inputs to the HSIP
7.0 Provide guidance and inputs on HFE performance feedback and user centered design
8.0 Review mockup/modeling results
8.1 Assess potential HFE risk areas
9.0 Participate in safety reviews
10.0 Provide inputs as required
11.0 Assess support plans and provide HFE inputs
12.0 Provide inputs as required
13.0 Incorporate any identifed HFE risks
14.0 Identify HFE opportunities for system operations, maintenance, and support
15.0 Identify HFE considerations for system support and life cycle affordability



References:

- AFI 63-101 & AFI 63-1201
- MIL-HDBK-46855 & MIL-HDBK-743A
- MIL-STD-1295A
- MIL-STD-1478 & MIL-STD-1472
- AFMAN 63-119

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- AVOSCET
- CATIA
- CSDT
- Delmia-Human
- DeSAT
- Watchstander Model
- HF-PFMEA

Engineering and Manufacturing Development (Inputs): Human Factors Engineering

A

- Develop HFE profle and system boundaries across the life cycle
- Embed HFE in requirements and acquisition documentation *i.e.,* ICD, CDD, APB, SEP, HSIP, TEMP, LCMP
- Identify and/or develop HFE-critical requirements and verify they are included in the requirements tracking system
- Develop detailed HFE criteria

B

- Initiate development of HFE analysis and risk metrics
- Update HFE criteria
- Understand all subsystem HMI and HFE requirements
- Review all trade studies for HFE impacts
- Expand HFE analysis to include functional specifcations
- Verify HFE critical functional specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Provide HFE input for demilitarization/disposal planning
- Identify HFE requirements in any system or subsystem solicitation or contract

C

- Update HFE criteria for components, subsystems, and systems (to include test requirements)
- Provide updated input for demilitarization/disposal planning
- Expand and update HFE limitations, risks, and attributes as detailed design specifcations evolve
- Verify HFE critical design specifcations are included in the requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan
- Ensure HFE is addressed as part of the overall PDR

D

- Ensure previously developed HFE requirements for systems or subsystems are traceable to the functional design documentation, including drawings and subcontracts
- Update HFE criteria for components, subsystems, and systems to include test and inspection requirements
- Identify HFE critical processes for product build-to documentation
- Include system HFE critical processes and components in inspection plan
- Participate in component design selections
- Review Level of Repair Analysis and Maintenance Task Analysis for HFE impacts
- Verify system HFE critical design specifcations are included in the requirements tracking system and detailed design specifcations as necessary

SFR

- Present HFE critical functions and risk status at SFR
- Ensure that HFE system requirements and HFE functional performance requirements (per the CDD) are fully defned
- Ensure HFE consistency with the mature system concept and that adequate HFE processes and metrics are in place
- Ensure HFE performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Ensure HFE requirements trace with the system design
- Ensure an HFE baseline has been allocated and is consistent across hardware/software elements
- Provide HFE inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Ensure HFE risks are identifed and manageable

CDR

- Ensure HFE risk areas have been addressed as required
- Ensure HFE requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure HFE issues have been addressed
- Indicate operational suitability and effectiveness of HFE effort/design for operational testing
- Identify key HFE characteristics impacting system performance, assembly, cost, reliability, or safety

Trades

- Participate in trade studies to evaluate options against HFE costs throughout this phase to ensure HFE concerns are addressed
- Coordinate with other HSI domains to assess trade-offs with HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem HFE requirements

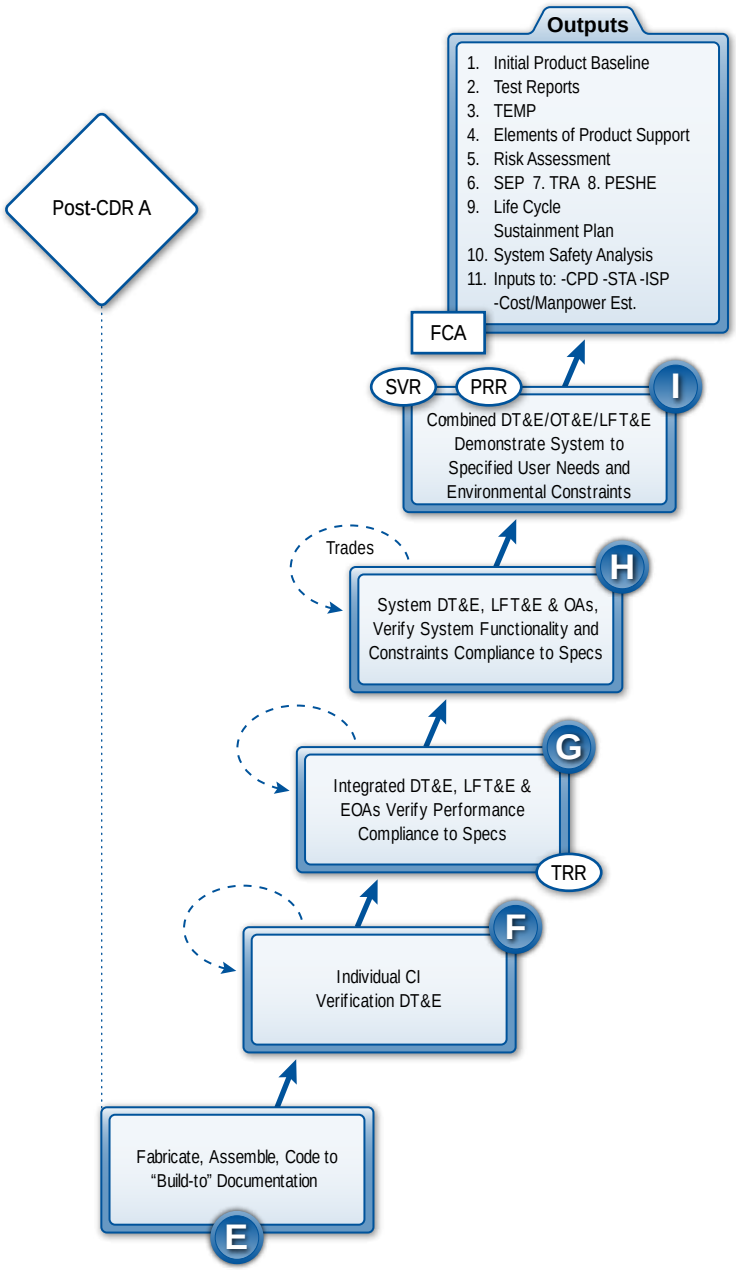
Post-PDR A

- Provide HFE input as required

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Human Factors Engineering



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Incorporate well established HFE requirements into system design
2.0 Review test reports and address any HFE issues
3.0 Verify mitigation controls reduce hazard risk effectively
3.1 Analyze anomalies, incidents and mishaps as they relate to HFE
4.0 Review and assess potential HFE impacts
5.0 Document and report on residual HFE risks/risk acceptance decisions
6.0 Update strategy for integrating HFE into SE
7.0 Update the mitigation technology readiness levels
8.0 Ensure HFE is addressed
9.0 Ensure completion of HFE issues
10.0 Coordinate with safety specialists to ensure HFE risks have been considered in system safety analyses
10.1 Update system attrition rate inputs
11.0 Recommend operational and maintenance training and staffng requirements
11.1 Assess HFE efforts
11.2 Ensure HFE inputs are included in LCMP

References:

- AFI 63-101 & AFI 63-1201
- MIL-STD-1295A
- MIL-STD-1472 & MIL-STD-1478
- MIL-HDBK-46855
- T.O. 00-35D-54

Tools:

- CATIA
- CSDT
- ErgoMaster, ErgoImager, ErgoWeb JET
- HFRA
- SAFEWORK

Engineering and Manufacturing Development (Outputs): Human Factors Engineering

E

- Evaluate process and design changes as necessary
- Review and recommend HFE updates to TEMP
- Ensure CI verifcation DT&E procedures include HFE requirements and verifcation testing
- Initiate HFE risk acceptance reviews and documentation as appropriate

F

- Update status of HFE risks and impacts
- Verify integrated DT&E, LFT&E, and EOA procedures include appropriate HFE tests
- Recommend HFE mitigation control measures based on DT&E test results as appropriate
- Initiate HFE risk acceptance reviews and documentation as appropriate
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Ensure test results mitigated HFE relevant challenges
- Update HFE impacts and risks based upon confguration changes
- Assess confguration changes for HFE tests and document results
- Provide updated HFE input for demilitarization/disposal planning
- Verify system DT&E, LFT&E, and EOA procedures include HFE appropriate tests
- Recommend HFE mitigation control measures based on test results
- Provide HFE risk review and acceptance for upcoming test activities as appropriate
- Ensure HFE requirements meet specifcation requirements
- Participate in DR boards for HFE implications

H

- Ensure test results mitigated HFE relevant challenges
- Update HFE status and analyses based upon confguration changes
- Assess confguration changes for HFE testing and document results as necessary
- Verify combined DT&E, LFT&E, and EOA procedures include appropriate HFE tests derived from system HSI analyses and reviews
- Recommend HFE mitigation control measures, as necessary
- Provide HFE risk review and acceptance for upcoming test activities as appropriate
- Ensure NEPA/EO 12114 compliance is completed prior to testing
- Ensure HFE issues are resolved
- Continue to participate in DR boards for HFE implications

I

- Ensure test results mitigated HFE relevant challenges
- Review operational supportability and interoperability certifcations for HFE impacts
- Address, characterize, and mitigate HFE risks
- Update HFE status and analyses based upon confguration changes
- Recommend HFE mitigation control measures as necessary
- Ensure NEPA/EO 12114 compliance is completed prior to testing
- Continue to participate in DR boards for HFE implications

TRR

- Assess confguration for testing HFE considerations
- Ensure all HFE risk acceptances are completed
- Report HFE risks and their status
- Ensure NEPA/EO 12114 Compliance

SVR

- Verify HFE requirements and constraints, as documented in the functional baseline, have been suffciently addressed in the system functionality assessment
- Ensure HFE risks to user and system are identifed and manageable, and that appropriate metrics associated with HFE are in place

PRR

- Present HFE critical requirements and risks as well as their acceptance status
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade HFE-related performance

FCA

- Review the FCA for consistency with HFE requirements
- Ensure HFE concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specifcation is met

Trades

- Participate in the trade studies to evaluate options against established criteria throughout this phase to ensure HFE concerns are addressed

Post-CDR A

- Assess HFE risks against exit criteria for this acquisition phase
- Identify those HFE risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

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The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

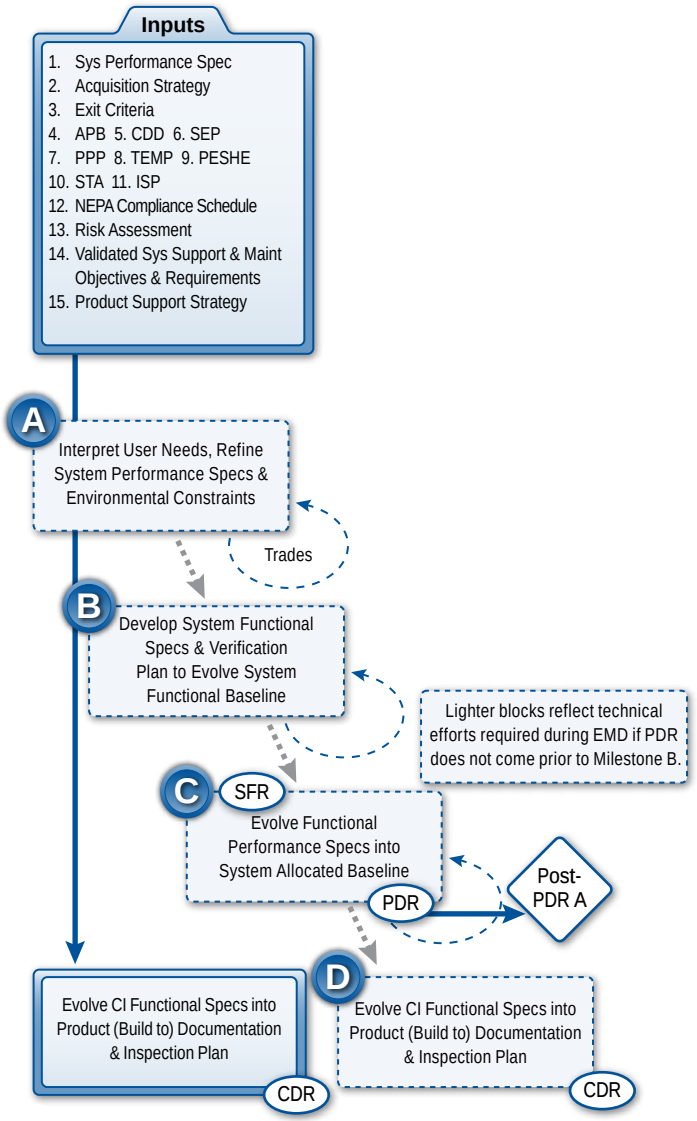
Survivability

Activities for Each Input:

1.0 Include applicable Sv specifcations
2.0 Identify safety concerns from PESHE, SSA, *etc.* if needed
3.0 Document risk control measures of identifed Sv limitations
3.1 Obtain concurrence/approval of mitigation control measures
4.0 Provide Sv inputs as requested
5.0 Identify hazard mitigation and mishap reduction requirements
6.0 Update strategy for integrating Sv risk management into the SEP/HSIP
6.1 Identify applicable review and approval boards
7.0 Provide inputs as required
8.0 Develop and document LFT&E strategy
9.0 Ensure PESHE includes preliminary ESOH risks (to include Sv), a strategy for integrating into SEP, and a method for tracking hazard progress
10.0 Ensure Sv levels are appropriate for anticipated threat levels
11.0 Provide guidance on Sv performance feedback and risk communication
12.0 Ensure inclusion of Sv in NEPA compliance schedule
13.0 Provide inputs as required
14.0 Defne initial Sv objectives and establish validation criteria
15.0 Identify Sv considerations for system support and life cycle affordability

References:

- DODD 5000.01 & DODI 5000.02
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1201
- 10 USC 2366
- AFMAN 63-119 & AFI 90-901
- DI-SAFT-80101B



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- ComputerMan
- BRAWLER
- COVART
- ESAMS
- FASTGEN
- RADGUNS

Engineering and Manufacturing Development (Inputs): Survivability

A

- Develop life cycle Sv profle and system boundaries
- Develop detailed Sv criteria
- Identify and/or develop Sv critical and asset requirements and verify they are included in the requirements tracking system

B

- Initiate development of Sv analysis and risk metrics
- Update Sv criteria
- Expand Sv analysis to include functional specifcations
- Verify Sv-critical functional specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Identify Sv requirements in any system or subsystem solicitation or contract
- Translate system Sv concept into preliminary design

C

- Finalize ESOH hazard and risk analysis for Sv impacts (*e.g.,* PHA, SHA, SSHA, and O&SHA)
- Update Sv criteria for components, subsystems, and systems to include test requirements
- Provide updated input for demilitarization/disposal planning
- Expand and update Sv limitations and risks as detailed design specifcations evolve
- Verify Sv-critical design specifcations are included in the requirements tracking system and in the CI Verifcation Plan

D

- Revise ESOH hazard and risk analysis (*e.g.,* SSHA) if necessary
- Identify Sv-critical processes for product build-to documentation (*e.g.,* computer-aided design or modeling)
- Include system Sv-critical processes and components in inspection plans
- Participate in component design selections
- Verify system Sv-critical design specifcations are included in requirements tracking system and detailed design specifcations as necessary

SFR

- Present Sv-critical functions and risk status at SFR
- Ensure Sv performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Present PHA and identify Sv hazards and risk status at PDR
- Ensure Sv risks are identifed and manageable
- Provide Sv inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations

CDR

- Ensure Sv requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure Sv issues have been addressed
- Ensure Sv risks have been addressed as required

Trades

- Participate in trade studies to evaluate options against established Sv criteria throughout this phase to ensure Sv concerns are addressed
- Coordinate with other HSI domains to assess trade-offs with HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem Sv

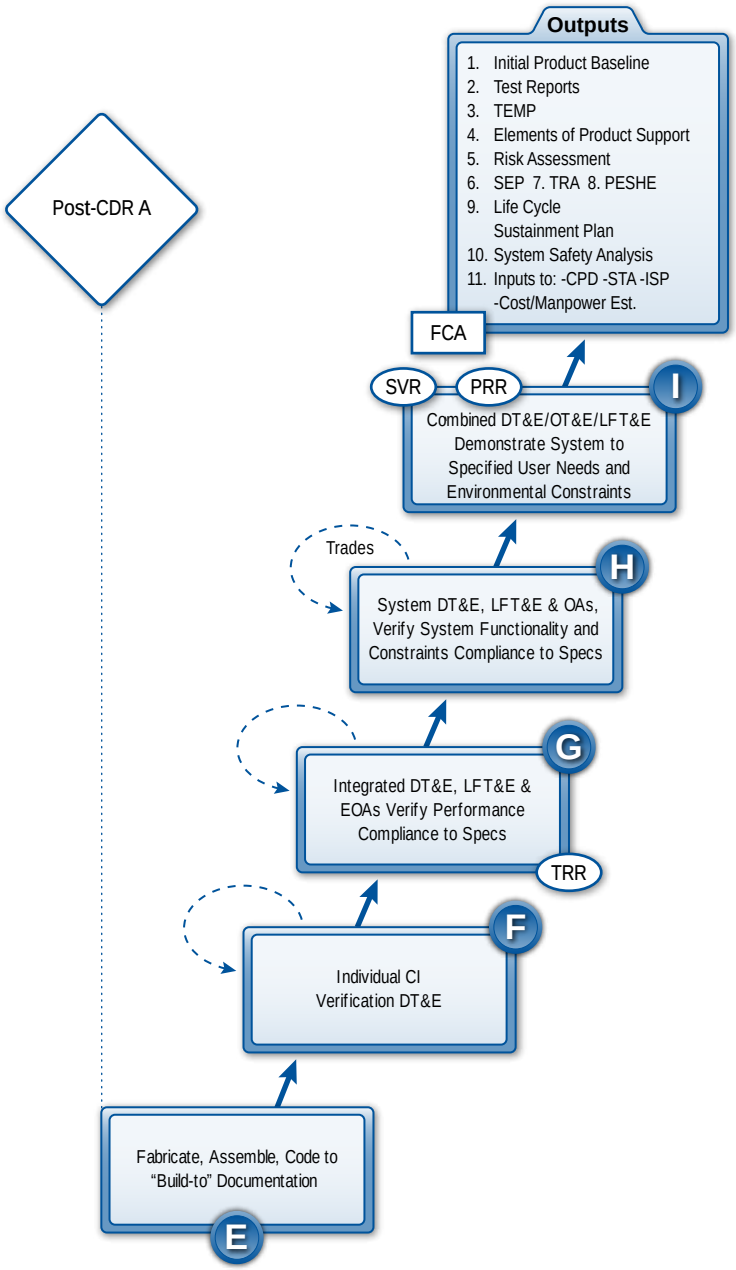
Post-PDR A

- Assess status of Sv for entire system

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Survivability



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Include Sv-critical processes
1.1 Identify inspection requirements
2.0 Verify mitigation controls increase Sv
2.1 Analyze anomalies, incidents, and Sv-related mishaps
3.0 Identify and include critical Sv characteristics and issues that require T&E
4.0 Provide the results of the system safety and hazard analyses (*e.g.*, O&SHA)
5.0 Document and report on residual risks and risk acceptance decisions
5.1 Document concurrence of applicable review boards
6.0 Update strategy for integrating Sv risk management into SEP
6.1 Identify applicable working groups and processes for concurrence
7.0 Update the Sv technology readiness levels
8.0 Update PESHE to include identifed Sv risk and strategy for integrating into SEP
9.0 Ensure Sv requirements are integrated into the LCMP
10.0 Include key Sv objectives such as vulnerability reduction and/or damage tolerance
11.1 Recommend operational and maintenance training and staffng requirements
11.2 Update system attrition rate inputs

References:

- DODD 5000.01 & DODI 5000.02
- 10 USC 2366
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1201
- AFMAN 63-119
- T.O. 00-35D-54

Tools:

- ComputerMan
- BRAWLER
- COVART
- ESAMS
- FASTGEN
- RADGUNS

Engineering and Manufacturing Development (Outputs): Survivability

E

- Evaluate process and design changes for Sv considerations
- Review and recommend Sv updates to TEMP
- Ensure CI verifcation DT&E procedures include Sv requirements and verifcation testing
- Initiate Sv risk acceptance reviews and documentation as necessary
- Integrate Sv concepts to produce working prototype of system

F

- Update Sv risks and impacts status
- Verify integrated DT&E, LFT&E, and EOA procedures include appropriate Sv tests
- Initiate Sv risk acceptance reviews and documentation as appropriate
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Ensure Sv analysis was conducted and test results reviewed for hazard control effectiveness
- Update Sv impacts and risk based upon confguration changes
- Assess confguration changes for Sv and document results
- Verify system DT&E, LFT&E, and EOA procedures include Sv appropriate tests
- Provide Sv risk review and acceptance for upcoming test activities
- Incorporate Sv objectives in the systems specifcation and integrated logistics support plan
- Participate in DR boards for safety implications

H

- Ensure test results mitigated Sv relevant challenges
- Update Sv status and analyses based upon confguration changes
- Assess confguration changes for Sv testing and document results
- Verify combined DT&E, LFT&E, and EOA procedures include appropriate Sv tests derived from Sv analysis and reviews
- Recommend Sv mitigation control measures as appropriate
- Provide Sv risk review and acceptance for upcoming test activities
- Continue to participate in DR boards for safety implications

I

- Ensure test results mitigated Sv relevant challenges
- Update Sv status and analyses based upon confguration changes
- Recommend Sv mitigation control measures as necessary
- Continue to participate in DR boards for safety implications

TRR

- Assess confguration for testing, document results, and present at TRR
- Ensure all Sv risk acceptances are completed in support of TRR
- Report Sv risks and their status at TRR
- Ensure NEPA/EO 12114 Compliance

SVR

- Verify Sv requirements and constraints, as documented in the functional baseline, have been suffciently addressed in the system functionality assessment
- Ensure Sv risks are identifed and manageable, and that appropriate metrics associated with Sv are in place

PRR

- Present Sv-critical requirements, risks, and their acceptance status at PRR
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade Sv-related performance

FCA

- Review the FCA for consistency with Sv requirements
- Ensure Sv concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specifcation is met

Trades

- Participate in the trade studies to evaluate Sv options against established criteria throughout the Engineering and Manufacturing Development phase and to ensure Sv concerns are addressed

Post-CDR A

- Assess Sv risks against exit criteria for this acquisition phase
- Identify those Sv risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

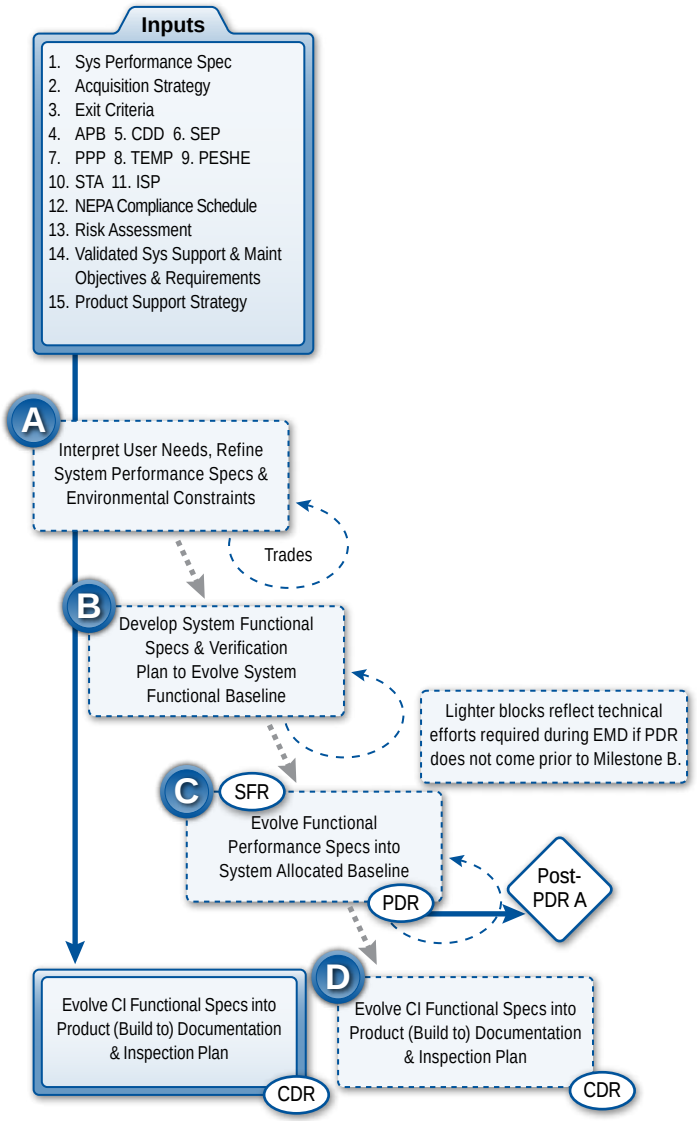
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Environment

Activities for Each Input:

1.0 Include SRCA data and critical environment system and sub system requirements
2.0 Provide environment inputs
3.0 Document risk disposition of identifed environment hazards
4.0 Ensure environment efforts are properly resourced
5.0 Identify environment hazard mitigation and include environment requirements objectives and thresholds for human performance
6.0 Include environment risks in SEP
7.0 Provide environment inputs
8.0 Incorporate environment test requirements into test planning and execution
9.0 Ensure PESHE includes environment responsibilities, risks (*e.g.*, HAZMAT), strategies for integration into SE, and methods for tracking hazard mitigation progress
10.0 Provide environment inputs
11.0 Identify information support needs to meet environment hazard management and reporting requirements
12.0 Ensure compliance schedule includes environment criteria
13.0 Develop risk assessment
14.0 Identify operations and maintenance support for environ-ment hazards and system performance risks
15.0 Identify environment criteria for future system operations and support



References:

- NEPA/EO 12114
- DODI 5000.02 & DODI 4715.x series
- MIL-STD-882D & MIL-STD-1425A
- MIL-STD 1472 & MIL-STD-1474D
- AFI 32-7086 & NAS 411: HMMP
- AFMAN 63-119 & AFI 63-1201
- DI-SAFT-80101B

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- ESOH Programmatic Risk Assessment Toolset
- FHA
- FTA
- HMIRS
- PESHE Checklist

Engineering and Manufacturing Development (Inputs): Environment

A

- Develop a life cycle environment profle and system constraints
- Develop detailed environment system criteria
- Verify environment inputs in acquisition documentation (*i.e.,* capabilities documents)
- Identify and develop environment critical and asset requirements and verify they are included in the requirements tracking system

B

- Initiate development of hazard analyses (*e.g.,* PHA and THA)
- Update environment criteria for system specifcations
- Review all trade studies for environment impacts
- Expand SRCA to ensure functional environment specifcations are included in the requirements tracking system and in the System Verifcation Plan
- Identify environment requirements in any system or subsystem solicitation or contract
- Verify NEPA/EO 12114 requirements are being met at proposed testing and training locations

C

- Update ESOH hazard and risk analysis for environment impacts (*e.g.,* PHL, SHA, SSHA, and O&SHA)
- Ensure documentation of environment impacts for SFR
- Update environment criteria for components, subsystems, and systems to include test requirements
- Expand and update SRCA as detailed design specifcations evolve
- Verify environment-critical design specifcations are included in requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan

D

- Review and fnalize ESOH hazard and risk analysis for environment impacts (*e.g.,* SSHA, SHA and O&SHA)
- Update environment criteria for components, subsystems, and systems to include test and inspection requirements
- Include critical environment processes and procedures in inspection plan
- Verify environment critical design specifcations are included in requirements tracking system and detailed design specifcations

SFR

- Identify environment criteria and ensure all hazards and risks are considered and documented
- Ensure consistency of environment criteria with cost, schedule, risks, and other system constraints
- Ensure all environment performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Provide environment inputs to the assessment of the system and subsystem preliminary design as captured in the confguration item specifcations
- Identify environment hazard and risk status
- Ensure environment risks are identifed and manageable
- Ensure all environment requirements are documented in system specifcations
- Evaluate feasibility of NEPA compliance schedule

CDR

- Document acceptance status of all environment hazards and risks especially those related to manufacturing processes, materials, and operations and support activities
- Update assessment of NEPA compliance schedule
- Ensure environment requirements and constraints have been addressed in the product specifcations for each confguration item
- Review design documentation as required to ensure environment issues have been addressed
- Ensure environment risks have been addressed as required

Trades

- Participate in trade-off studies to evaluate options against established environment criteria for the Engineering and Manufacturing Development Phase to ensure environment concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem environment requirements

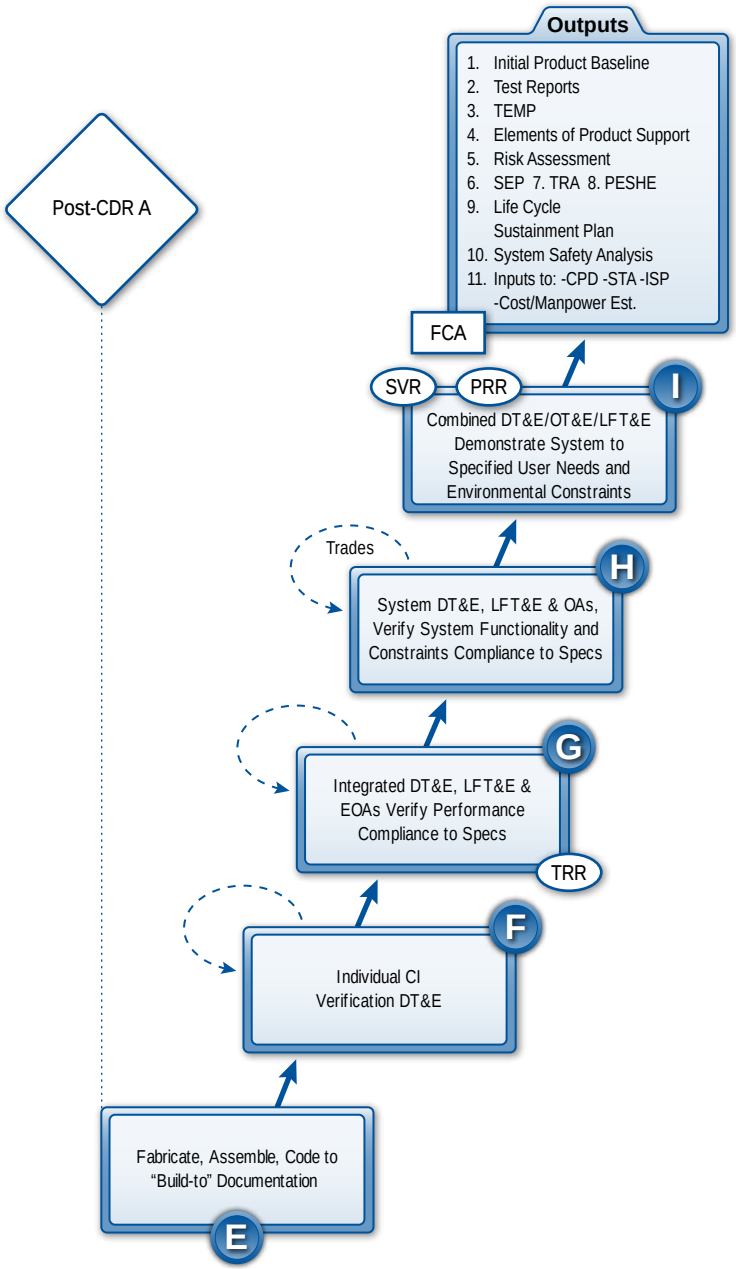
Post-PDR A

- Assess status of environment for entire system components and entire system

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Environment



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Include environment critical items and processes in baseline and identify inspection requirements
2.0 Analyze anomalies, incidents, and environment related mishaps
3.0 Verify that mitigation controls effectively reduce hazard risks
4.0 Include environment considerations in product support strategy for trade-offs & analysis
5.0 Document and report residual risks and environment risk acceptance decisions
6.0 Update strategy for integrating environment risk management into SE
7.0 Assess technology readiness levels for all environment related issue mitigation methods
8.0 Update PESHE to include identifed environment responsibilities, risks (*e.g.*, HAZMAT), strategies for integration into SE, and methods for tracking hazard progress
9.0 Include environment considerations, reporting, and constraints for entire life cycle as currently identifed in LCMP
10.0 Identify environment requirements, constraints, and system performance attributes
11.0 Recommend operational and maintenance training and staffng requirements for environment
11.1 Update system attrition rate inputs due to hazard mitigation, and mishap reduction requirements

References:

- NEPA/EO 12114
- DODI 5000.02 & DODI 4715.4
- MIL-STD-882D & MIL-STD-1425A
- MIL-STD 1472 & MIL-STD-1474D
- AFI 32-7086 & AFI 63-101
- NAS 411: HMMP
- T.O. 00-35D-54

Tools:

- PESHE Checklist
- ESOH Programmatic Risk Assessment Toolset
- FHA
- HMIRS

Engineering and Manufacturing Development (Outputs): Environment

E

- Evaluate process and design changes for environment considerations
- Review and recommend environment updates to TEMP
- Initiate environment hazard risk acceptance reviews and documentation

F

- Ensure environment tests were conducted and results reviewed for hazard control effectiveness and risk mitigation
- Update hazard status
- Verify integrated DT&E, LFT&E, and EOA procedures include appropriate tests derived from environment analyses
- Recommend hazard closure and mitigation control measures based on DT&E test results
- Provide safety release and hazard risk acceptance documentation
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Ensure environment tests were conducted and test results reviewed for hazard control effectiveness
- Update environment hazard status and hazard analyses based on any configuration changes
- Assess testing configuration changes and document any environment impacts
- Verify system DT&E, LFT&E, and EOA procedures include appropriate tests derived from environment analyses
- Recommend hazard mitigation or closure based on test results
- Provide safety release and hazard risk acceptance for upcoming test activities
- Ensure environment requirements meet specification requirements
- Participate in DR boards for environment implications

H

- Ensure environment tests were conducted and test results reviewed for hazard control effectiveness
- Update hazard status and analyses based upon configuration changes
- Assess testing configuration changes and document any environment impacts
- Verify combined test procedures include appropriate environment tests, as derived from environment analyses and reviews
- Recommend hazard closure or risk mitigation based on test results
- Provide safety release and hazard risk review and acceptance for upcoming test activities
- Ensure environment issues are resolved
- Continue to participate in DR boards for environment implications

I

- Ensure NEPA/EO 12114 compliance is completed prior to testing
- Ensure environment tests were conducted and test results reviewed for hazard control effectiveness
- Ensure environment hazard risks are addressed, characterized, and mitigated
- Update hazard status and analyses based upon configuration changes
- Recommend hazard closure or risk mitigation control measures
- Continue to participate in DR boards for environment implications

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TRR

- Assess and document configuration for testing and document results
- Ensure completion of safety releases and completion of environment risk acceptance
- Ensure NEPA/EO 12114 compliance

SVR

- When system functionality is assessed, verify that environment requirements and constraints, as documented in the functional baseline, have been sufficiently addressed
- Ensure environment risks to users are identified and manageable, and that appropriate metrics associated with environment are in place
- Provide any risk mitigation and hazard controls

PRR

- Provide environment-critical specifications
- Document environment risks and their acceptance status
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade environment-related performance

FCA

- Review functional performance results for consistency with environment requirements
- Ensure environment concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specification is met

Trades

- Participate in trade-off studies to evaluate environment options against established criteria throughout the Engineering and Manufacturing Development Phase and to ensure environment concerns are addressed

Post-CDR A

- Assess environment risks against exit criteria for this acquisition phase
- Identify those environment risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

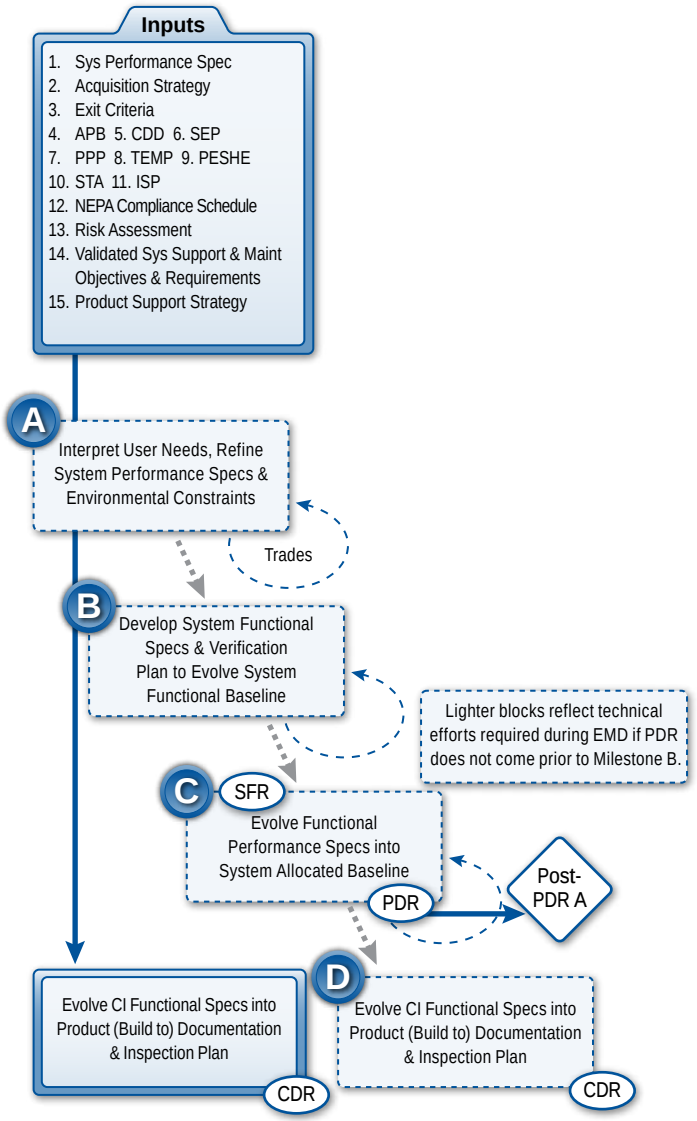
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Safety

Activities for Each Input:

1.0 Include SRCA data, critical system, operator safety system and subsystem requirements
2.0 Include safety concerns from PESHE and SSA if needed
3.0 Ensure risk mitigation for identified safety hazards
4.0 Ensure safety requirements are resourced
5.0 Identify safety risk mitigation requirements
5.1 Identify detailed safety requirements objectives and thresholds for human performance
6.0 Update strategy for integrating safety risk management in SE
7.0 Provide safety inputs as needed
8.0 Identify specific safety test requirements for hazards, human injury, mishaps & accepted risks
9.0 Incorporate safety risks, SE integration strategies, and hazard tracking methodology
10.0 Balance requirements with STA offset technologies
11.0 Assess shortfalls, issues, and plans with respect to safety
12.0 Provide inputs if needed
13.0 Develop risk assessment with safety hazard inputs considering all applicable safety disciplines
14.0 Ensure safety requirements for support and maintenance are documented
14.1 Identify system and operator safety risks associated with operations and maintenance
15.0 Identify safety criteria for future system operations and support



References:

- MIL-STD-882D
- DAG
- DoD System Safety Handbook
- AFI 63-1201
- AFI 63-101
- AFPD 90-8 & AFMAN 63-119
- AFI 91 Series

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- PESHE Checklist
- ESOH Programmatic Risk Assessment Toolset
- ORCA, HMIRS, HFACS, HFIX
- 3D System Safety Engineering Analysis
- AFSAS

Engineering and Manufacturing Development (Inputs): Safety

A

- Develop a life cycle safety and mishap prevention profle and system constraints
- Develop detailed system safety criteria
- Validate safety requirements are reflected in acquisition documentation (capabilities documents, system specifcations, *etc.*)
- Verify safety-critical requirements are embedded in the requirements tracking system

B

- Revise ESOH hazard and risk analysis (*e.g.,* PHA and THA)
- Update safety criteria for system and functional specifcations
- Review all trade studies for safety hazards and impacts
- Expand SRCA to ensure functional system safety specifcations are included in the requirements tracking system and in the System Verifcation Plan

C

- Finalize ESOH hazard and risk analysis (*e.g.,* PHL, SHA, SSHA, and O&SHA)
- Finalize requirements to support SFR
- Update safety criteria for components, subsystems, and systems to include test requirements
- Expand and update SRCA as detailed design specifcations evolve
- Verify safety critical design specifcations are included in the requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan
- Revise safety requirements in systems or subsystems solicitations or contracts

D

- Update safety criteria for components, subsystems, and systems to include test and inspection requirements
- Devise safety compliance criteria and schedules for system development inspection processes and procedures
- Verify safety critical design specifcations are included in the requirements tracking system and detailed design specifcations
- Participate in CCB to include reviewing ECPs

SFR

- Provide safety critical impacts and hazard risk status
- Identify safety criteria and ensure all hazards and risks are considered and documented, including those associated with system operations and product support
- Ensure all safety performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Provide safety inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Assess safety, hazards, and residual risk status
- Ensure safety risks are identifed and manageable
- Ensure all safety requirements are documented in system specifcations
- Identify and perform initial evaluation of safety issues as part of the total system
- Ensure preliminary design will not cause unacceptable hazards, risks, and mishaps
- Recommend PDR action items to resolve safety defciencies

CDR

- Document acceptance status of all safety hazards and risks
- Ensure safety risks have been addressed as required
- Ensure design meets defned system safety design and safety standards; document non-compliance areas
- Defne risk mitigation control measures to address unresolved hazards or non-compliance areas
- Ensure safety requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure safety issues have been addressed

Trades

- Participate in trade-off studies throughout the Engineering and Manufacturing Development Phase to ensure safety concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem safety

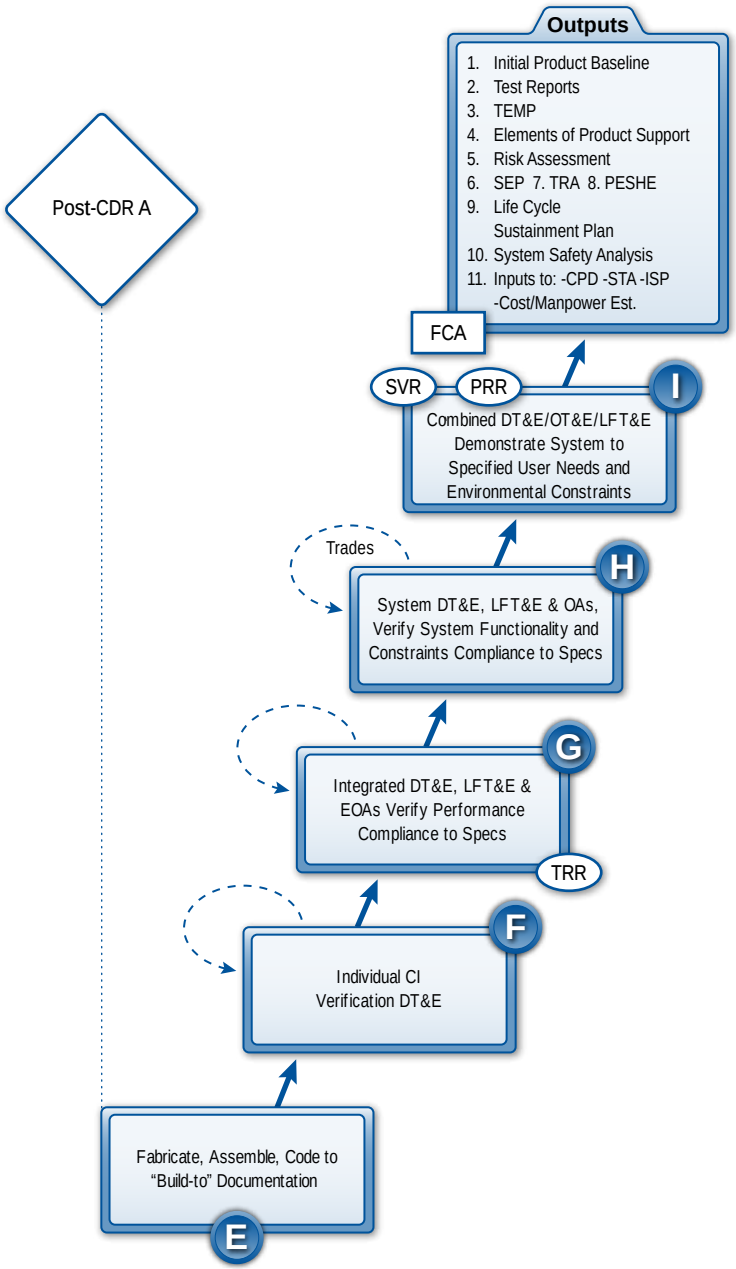
Post-PDR A

- Continue to assess overall system safety design as system evolves

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Safety



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Verify that safety critical designs are defned and compliance criteria processes are established
2.0 Verify mitigation controls reduce hazard risks effectively; analyze anomalies, incidents, and mishaps
3.0 Revise safety testing requirements as needed and validate test articles are released with viable mitigation control measures
4.0 Include safety considerations in product support strategy for trade-offs and analysis
5.0 Document and report residual risks/risk acceptance decisions
6.0 Update strategy for integrating safety risk management into SE
7.0 Identify mishap mitigation technology readiness levels
8.0 Update identifed safety risks, SE integration strategy, safety responsibilities, and methods for tracking hazard progress
9.0 Include safety hazard constraints for the entire life cycle, including demilitarization and disposal
10.0 Ensure completion of ESOH hazard and risk analysis (*e.g.*, PHA and SRCA, development of SSHAs, SHA, and O&SHA)
10.1 Identify safety requirements, constraints, and performance attributes
11.0 Recommend operations and maintenance safety training and staffng requirements
11.1 Update system attrition rate inputs
11.2 Update inputs to LCMP

References:

- MIL-STD-882D
- DAG
- DoD System Safety Handbook
- AFI 63-1201 & AFI 63-101
- AFPD 90-8 & AFMAN 63-119
- AFI 91 Series
- T.O. 00-35D-54

Tools:

- PESHE Checklist
- ESOH Programmatic Risk Assessment Toolset
- ORCA, HMIRS, HFACS, HFIX, AFSAS
- 3D System Safety Engineering Analysis
- RiskSafe 7

Engineering and Manufacturing Development (Outputs): Safety

E

- Validate safety design requirements
- Review and recommend safety updates to TEMP
- Review safety releases and hazard risk acceptance reviews and documentation

F

- Ensure safety tests were conducted and results reviewed for safety warning systems, hazard control effectiveness, and risk mitigation
- Ensure CI Verifcation DT&E procedures include safety compliance requirements and verifcation testing
- Participate in development of system DR procedures (T.O. 00-35D-54)
- Verify integrated DT&E, LFT&E, and EOA procedures include appropriate tests derived from system safety analyses
- Recommend hazard closure and mitigation control measures based on DT&E test results
- Provide safety release and hazard risk acceptance documentation

G

- Ensure system safety tests were conducted and test results reviewed for system and hazard control effectiveness
- Update hazard status and hazard analyses for human issues based on any confguration changes
- Assess confguration changes for test and document results
- Verify system DT&E, LFT&E, and EOA procedures include appropriate tests derived from system safety analyses
- Recommend hazard closure based on test results
- Provide safety release and hazard risk acceptance for upcoming test activities
- Ensure safety specifcation requirements have been verifed
- Participate in CCB to include reviewing ECPs
- Participate in DR boards for safety implications

H

- Ensure safety tests were conducted and test results reviewed for hazard control effectiveness
- Update hazard tracking status and analyses based upon confguration changes
- Assess confguration changes for testing and document results (*e.g.,* safety assessment)
- Verify combined test procedures include appropriate safety tests as derived from system safety analyses and reviews
- Recommend hazard closure or risk mitigation based on test results
- Provide safety release, hazard review, and risk acceptance for test activities
- Document unresolved safety defciencies
- Ensure continued participation in DR boards

I

- Ensure safety tests were conducted and test results reviewed for hazard control effectiveness
- Verify safety parameters support user's mission capability specifcations
- Update hazard status and analyses based upon confguration changes
- Recommend hazard closure or risk mitigation control measures
- Continue participation in DR boards

TRR

- Assess system confguration for testing, document safety assessment, and article release
- Ensure completion of safety releases and risk acceptance

SVR

- Verify safety requirements and constraints, as documented in the functional baseline, have been suffciently addressed in the system functional assessment
- Ensure safety risks are identifed and manageable, and that appropriate metrics associated with safety are in place
- Highlight risk mitigation and hazard control measures

PRR

- Validate safety critical specifcations are documented
- Document safety risks and their acceptance status
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade safety-related performance

FCA

- Review for consistency with safety and human requirements
- Ensure safety concerns are addressed when reviewing the CI's test/analysis data, including the software unit test results, to validate the intended function or performance stated in its specifcation is met

Trades

- Participate in trade-off studies to evaluate safety options against established criteria throughout the Engineering and Manufacturing Development Phase and to ensure safety concerns are addressed

Post-CDR A

- Assess safety risks against exit criteria for this acquisition phase
- Identify those safety risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

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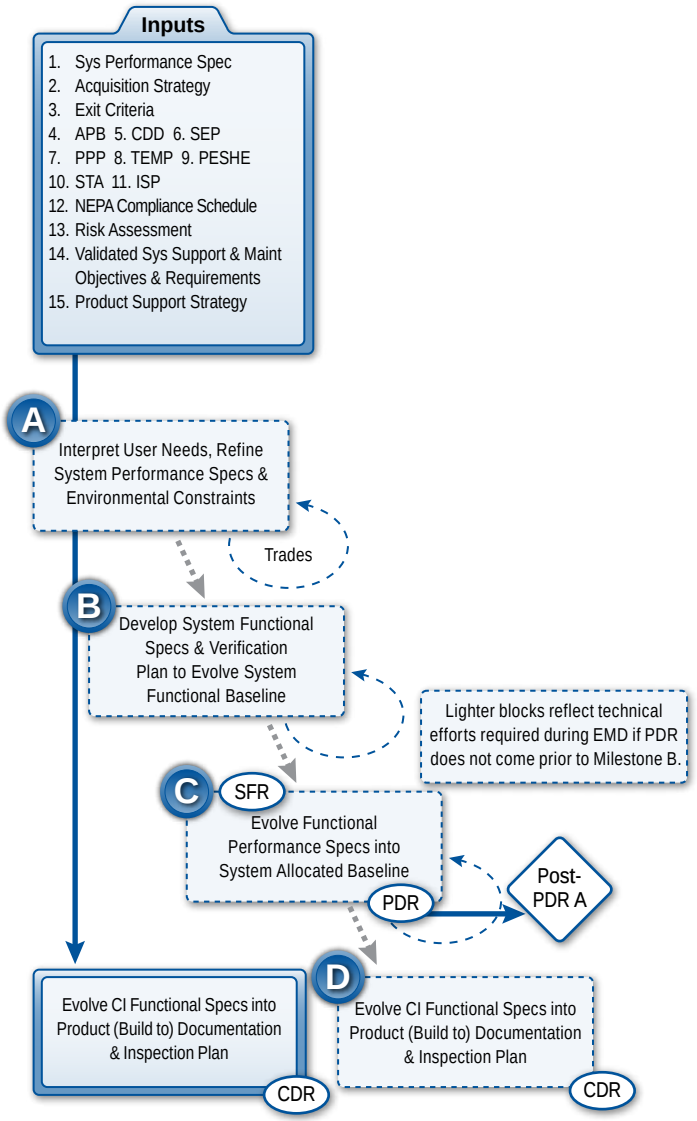
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Occupational Health

Activities for Each Input:

1.0 Include SRCA data and critical OH system and subsystem requirements
2.0 Provide inputs
3.0 Ensure risk mitigation for identifed OH hazards
4.0 Ensure OH efforts are properly resourced
5.0 Identify OH hazard mitigation and include OH requirements objectives and thresholds for human performance
6.0 Update strategy for integrating OH risk management in SE
7.0 Provide OH inputs as needed
8.0 Identify specifc OH test requirements for hazards, human injury, and accepted risks
9.0 Ensure PESHE includes OH risks, strategy for integration into SE, OH responsibilities, and methods for tracking hazard progress
10.0 Provide OH inputs as needed
11.0 Provide inputs on performance feedback and hazard identifcation and communication
12.0 Ensure inclusion of OH
13.0 Develop risk assessment with OH hazard inputs considering all applicable sub-domain criteria
14.0 Identify OH hazards and risks associated with system operations and maintenance
15.0 Identify OH criteria for future system operations and support



References:

- MIL-STD-882D
- DAG
- DoD System Safety Handbook
- DODI 6055.05
- AFI 32-7086
- AFI 63-1201 & AFI 63-101
- AFPD 90-8

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- HMIRS
- Cost Avoidance Methodology
- AHAAH
- ESOH Programmatic Risk Assessment Toolset
- PESHE Checklist
- BEE, DOEHRS

Engineering and Manufacturing Development (Inputs): Occupational Health

A

- Develop a life cycle OH profle and system restraints
- Develop detailed OH system criteria
- Verify OH inputs in acquisition documentation (*i.e.,* capabilities documents, system specifcations, *etc.*)
- Identify and develop OH critical requirements and verify they are included in the requirements tracking system

B

- Initiate development of ESOH hazard and risk analysis (*e.g.,* PHA and THA)
- Update OH criteria for system and functional specifcations
- Review all trade studies for OH impacts
- Expand SRCA to ensure functional OH specifcations are included in the requirements tracking system and in the System Verifcation Plan

C

- Finalize ESOH hazard and risk analysis for OH impacts (*e.g.,* PHL, SHA, SSHA, and O&SHA)
- Ensure documentation of OH impacts for SFR
- Update OH criteria for components, subsystems, and systems to include test requirements
- Expand and update SRCA as detailed design specifcations evolve
- Verify OH critical design specifcations are included in the requirements tracking system, detailed design specifcations, and in the CI Verifcation Plan
- Review OH requirements in any system or subsystem solicitation or contract

D

- Update OH criteria for components, subsystems, and systems to include test and inspection requirements
- Include critical OH processes and procedures in inspection plans
- Verify OH critical design specifcations are included in the requirements tracking system and detailed design specifcations

SFR

- Provide OH critical impacts and hazard risk status
- Identify OH criteria and ensure all hazards and risks are considered and documented, including those associated with system operations and product support
- Ensure all OH performance requirements that affect system requirements derived from the CDD are testable and are defned in the system functional baseline

PDR

- Assess OH hazard and risk status
- Ensure OH risks are identifed and manageable
- Ensure all OH requirements are documented in system specifcations
- Identify and perform initial evaluation of OH hazards and issues as part of the total system
- Ensure preliminary design will not cause unacceptable OH issues
- Recommend PDR action items to resolve OH problem areas
- Provide OH inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations

CDR

- Document acceptance status of all OH hazards and risks
- Ensure design meets OH standards; identify issues
- Document non-compliance areas
- Defne risk mitigation control measures to address unresolved hazards or non-compliance areas
- Ensure OH requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure OH issues have been addressed

Trades

- Participate in trade-off studies to evaluate options against established OH criteria for the Engineering and Manufacturing Development Phase and to ensure OH concerns are addressed
- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem OH requirements

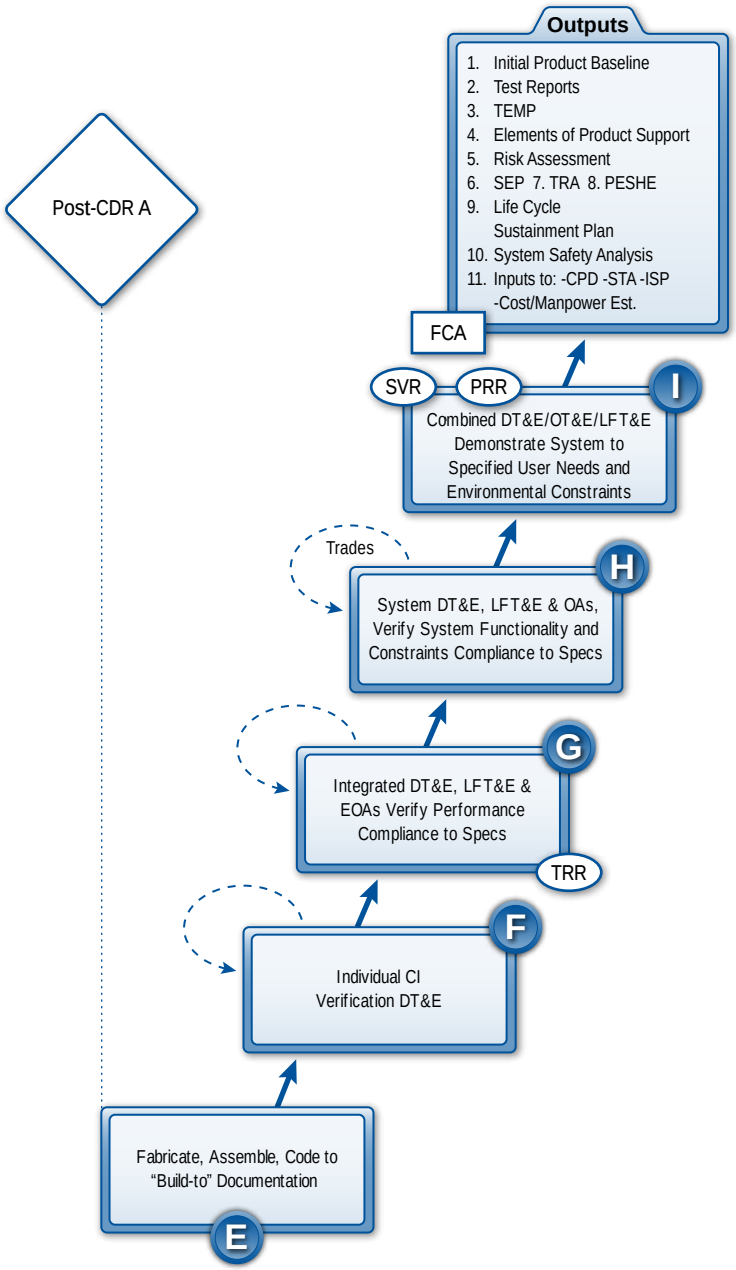
Post-PDR A

- Assess status of OH for entire system components and entire system

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Occupational Health



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Include OH critical items and processes in the baseline and identify inspection requirements
2.0 Verify that mitigation controls effectively reduce hazard risks
2.1 Analyze anomalies, incidents, and OH related mishaps
3.0 Ensure OH hazards and mitigation techniques will be evaluated during system testing
4.0 Include OH considerations in product support strategy for trade-offs and analysis
5.0 Document and report residual risks/risk acceptance decisions
6.0 Update risk management integration strategy into SE
7.0 Identify mitigation technology readiness levels for OH issues
8.0 Update PESHE to include identifed OH risks, strategy for integration into SE, and OH responsibilities and methods for tracking hazard progress
9.0 Include OH and hazard constraints for entire life cycle, including demilitarization and disposal
10.0 Identify OH requirements, constraints, and system performance attributes
11.0 Recommend operational and maintenance training and staffng requirements for OH
11.1 Update system attrition rate inputs

References:

- MIL-STD-882D
- DoD System Safety Handbook
- DODI 6055.05
- AFI 32-7086
- AFI 63-1201 & AFI 63-101
- AFPD 90-8
- T.O. 00-35D-54

Tools:

- HMIRS
- DOORS
- Cost Avoidance Methodology
- ESOH Programmatic Risk Assessment Toolset
- PESHE Checklist
- BEE, DOEHRS

Engineering and Manufacturing Development (Outputs): Occupational Health

E

- Evaluate process and design changes for OH considerations
- Review and recommend OH updates to TEMP
- Initiate OH hazard risk acceptance reviews and documentation

F

- Ensure OH tests were conducted and results reviewed for hazard control effectiveness and risk mitigation
- Update hazard status
- Verify integrated DT&E, LFT&E, and EOA procedures include appropriate tests derived from OH analyses
- Recommend hazard closure and mitigation control measures based on DT&E test results
- Provide safety release and hazard risk acceptance documentation
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Ensure OH tests were conducted and test results reviewed for hazard control effectiveness
- Update OH hazard status and hazard analyses based on any configuration changes
- Assess configuration changes for testing and document results
- Verify system DT&E, LFT&E, and EOA procedures include appropriate tests derived from OH analyses
- Recommend hazard mitigation or closure based on test results
- Provide safety release and hazard risk acceptance for upcoming test activities
- Ensure OH specification requirements have been verified
- Participate in DR boards for OH implications

H

- Ensure OH tests were conducted and test results reviewed for hazard control effectiveness
- Update hazard status and analyses based upon configuration changes
- Assess configuration changes for testing and document results
- Verify combined test procedures include appropriate OH tests, as derived from OH analyses and reviews
- Recommend hazard closure or risk mitigation based on test results
- Provide safety release and hazard risk review and acceptance for upcoming test activities
- Document unresolved OH issues
- Continue to participate in DR boards for OH implications

I

- Ensure OH tests were conducted and test results reviewed for hazard control effectiveness
- Ensure OH hazard risks are addressed, characterized, and mitigated
- Update hazard status and analyses based upon configuration changes
- Recommend hazard closure or risk mitigation control measures
- Continue to participate in DR boards for OH implications

TRR

- Assess configuration for testing and document OH assessment
- Ensure safety releases and OH risk acceptances are completed

SVR

- Verify OH requirements and constraints, as documented in the functional baseline, have been sufficiently addressed in the system functionality assessment
- Ensure all OH risks are identified and manageable, and that appropriate metrics associated with OH are in place
- Provide any risk mitigation and hazard controls

PRR

- Provide OH critical specifications
- Document OH risks and their acceptance status
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade OH performance

FCA

- Review for consistency with OH requirements
- Identify and document any HAZMAT from engineering and production drawings
- Ensure OH concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specification is met

Trades

- Participate in trade-off studies to evaluate OH options against established criteria throughout the Engineering and Manufacturing Development Phase and to ensure OH concerns are addressed

Post-CDR A

- Assess OH risks against exit criteria for this acquisition phase
- Identify those OH risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

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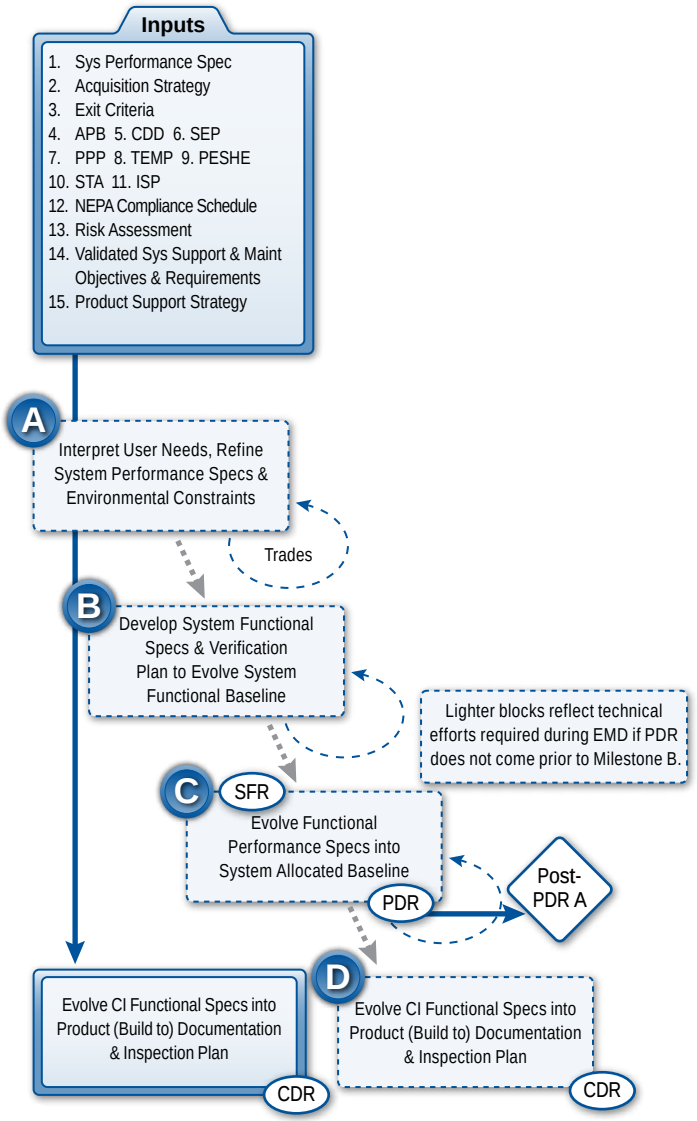
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Inputs)

Habitability

Activities for Each Input:

1.0 Provide habitability inputs to system performance specifcations
1.1 Include military or civilian specifcations as required (MIL-STD, NASA, *etc.*)
2.0 Provide habitability inputs as required
3.0 Provide critical habitability thresholds required to progress to next acquisition phase
4.0 Verify habitability inputs are included in the APB and provide inputs as required
5.0 Update habitability inputs to the CDD
6.0 Update the habitability section of the HSIP
7.0 Provide habitability inputs as requested
8.0 Update habitability risk areas to determine test strategies and resources required
9.0 Coordinate with ESOH specialists to ensure habitability risks have been addressed in the PESHE
10.0 Provide inputs as requested
11.0 Provide inputs as requested
12.0 Coordinate with ESOH specialists to provide habitability inputs as requested
13.0 Update habitability risk areas
14.0 Provide habitability constraints to system support and maintenance objectives
15.0 Provide habitability inputs to total ownership cost assessments



References:

- DODI 5000.02 & DAG
- NASA-STD-3001 Vol II
- AFI 63-101
- T.O. 00-35D-54

Tools:

- NHV
- Index of Habitability
- IMPRINT, CATIA, JACK
- Scale mockups
- Anthropometry measurements

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Engineering and Manufacturing Development (Inputs): Habitability

A

- Update habitability constraints
- Develop habitability criteria for: available space and privacy, egress, ergonomics, access to water and nutrition, hygiene, berthing, temperature and noise control, and support facilities
- Identify habitability technology needs

B

- Update habitability performance criteria
- Provide habitability inputs to system functional performance requirements
- Develop habitability subsystem evaluation criteria

C

- Update habitability performance criteria
- Provide habitability inputs to system functional performance requirements
- Develop habitability subsystem evaluation criteria

D

- Provide habitability inputs to product specifcations and drawings
- Review modeling and mockup data as required

SFR

- Ensure all habitability performance requirements that affect system requirements derived from the CDD are testable and defned in the system functional baseline

PDR

- Provide habitability inputs to the assessment of the system and subsystem preliminary design as captured in the CI specifcations
- Ensure habitability risks are identifed and manageable

CDR

- Ensure habitability requirements and constraints have been addressed in the product specifcations for each CI
- Review design documentation as required to ensure habitability issues have been addressed
- Ensure habitability risk areas have been addressed as required

Trades

- Coordinate with other HSI domains to assess trade-offs within HSI
- Coordinate with systems engineers to provide inputs to trade-offs that affect system and subsystem habitability

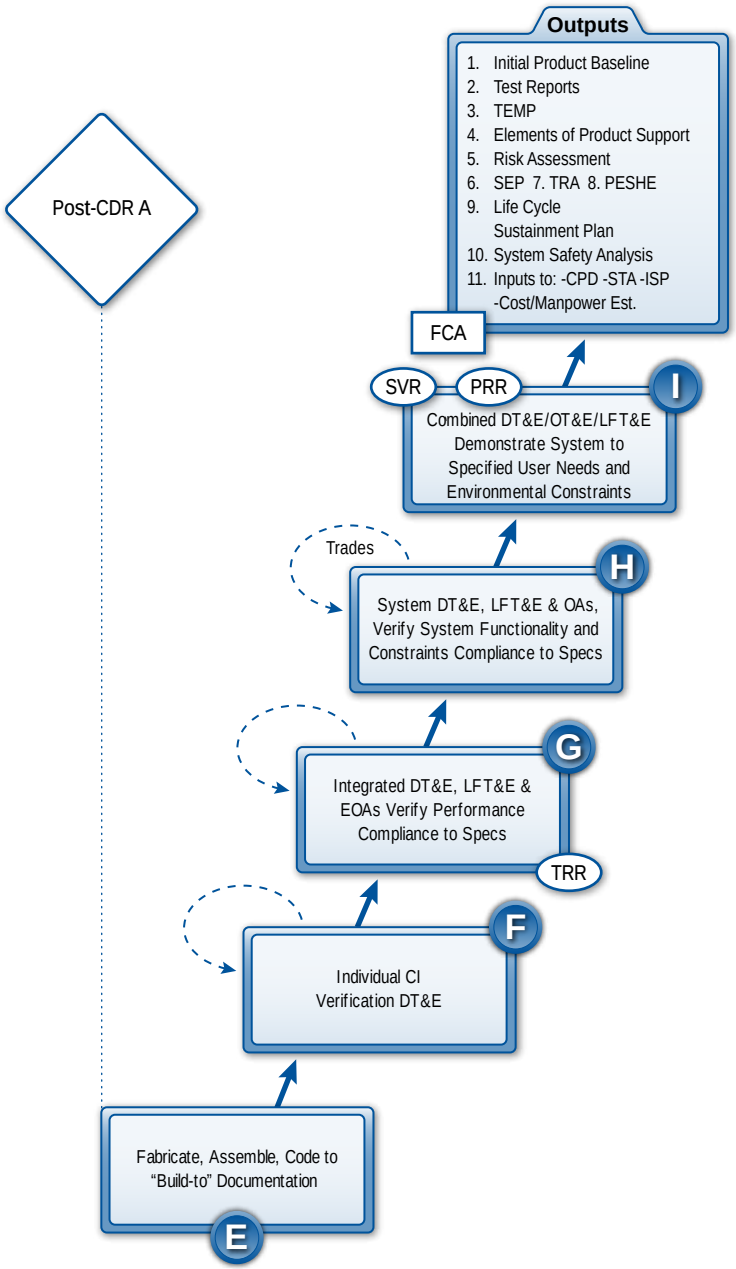
Post-PDR A

- N/A

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Engineering & Manufacturing Development Phase (Outputs)

Habitability



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Verify that habitability characteristics have been addressed in the CIs in the initial product baseline
2.0 Review test reports for habitability implications
2.1 Document test results for habitability-specifc testing
3.0 Ensure top-level habitability strategies are documented in the TEMP
4.0 Identify habitability implications for maintenance and support facilities and work areas
4.1 Coordinate with ESOH specialists to address habitability issues
5.0 Coordinate with ESOH POCs and update habitability risks as required
6.0 Update habitability inputs to HSIP within the SEP
7.0 Update status of critical habitability technologies
8.0 Coordinate with ESOH specialists to determine which habitability considerations have been addressed in the PESHE
9.0 Provide LCMP inputs for long term habitability constraints that affect total cost of ownership
10.0 Coordinate with safety specialists to determine if habitability considerations that impact safety have been included
11.0 Provide inputs as required
11.1 Coordinate manpower inputs with potential habitability constraints

References:

- DODI 5000.02 & DAG
- NASA-STD-3001 Vol II
- AFI 63-101
- T.O. 00-35D-54

Tools:

- NHV
- Index of Habitability
- IMPRINT, CATIA, JACK
- Scale mockups
- Anthropometry measurements

Engineering and Manufacturing Development (Outputs): Habitability

E

- Ensure habitability requirements and constraints are carried through to the "build-to" documentation

F

- Verify habitability risks are addressed in DT&E of individual CIs
- Review results of mock-up evaluations and models to determine habitability impacts
- Review test results for individual CIs to verify habitability requirements are addressed
- Participate in the development of a T.O. 00-35D-54-compliant DR process

G

- Verify that habitability requirements and constraints are included in integrated DT&E and EOA test plans
- Participate in DR boards for habitability implications

H

- Verify that habitability requirements and constraints are included in system DT&E and EOA test plans
- Continue to participate in DR boards for habitability implications

I

- Verify that operational habitability requirements and constraints are included in combined DT&E/OT&E and EOA test plans
- Continue to participate in DR boards for habitability implications

TRR

- Verify that habitability requirements, risks, and constraints have been included in the test objectives.
- Verify habitability resources (mock-ups, personnel, data collection resources, *etc.*) are available to support test activities as required

SVR

- Verify habitability requirements and constraints, as documented in the functional baseline, have been sufficiently addressed in the system functional assessment
- Ensure habitability risks are identified and manageable, and that appropriate metrics associated with habitability are in place

PRR

- Verify that habitability requirements, risks, and constraints have been sufficiently addressed
- Ensure a process is in place that will assess changes to the design or manufacturing processes to ensure changes will not degrade habitability-related performance

FCA

- Ensure habitability concerns are addressed when reviewing the CI's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specification is met

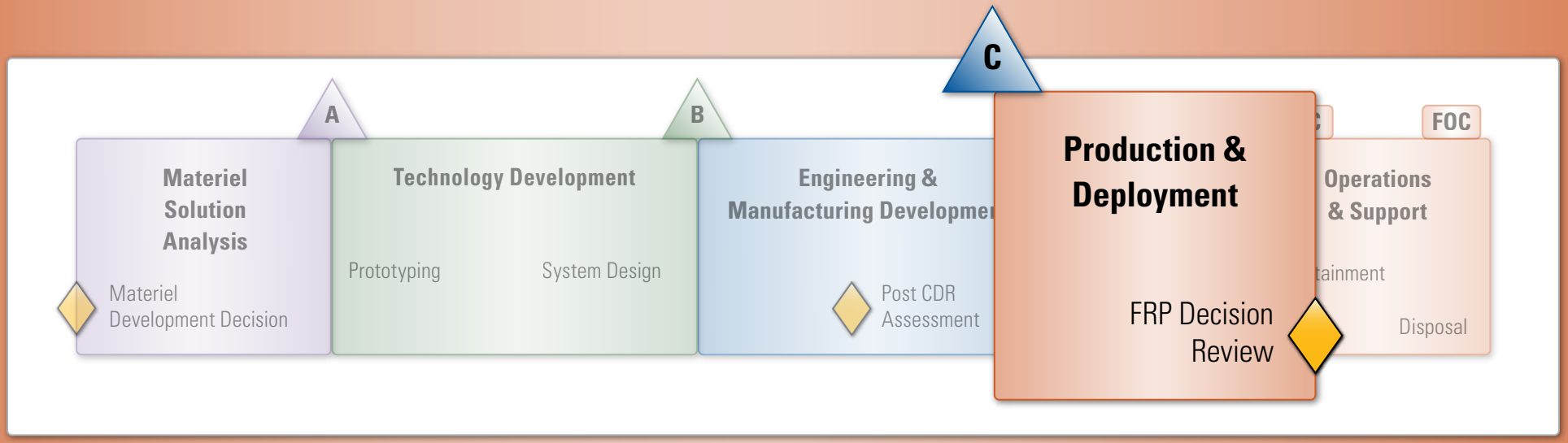
Trades

- Participate in trade-off analyses as required to ensure habitability concerns are addressed

Post-CDR A

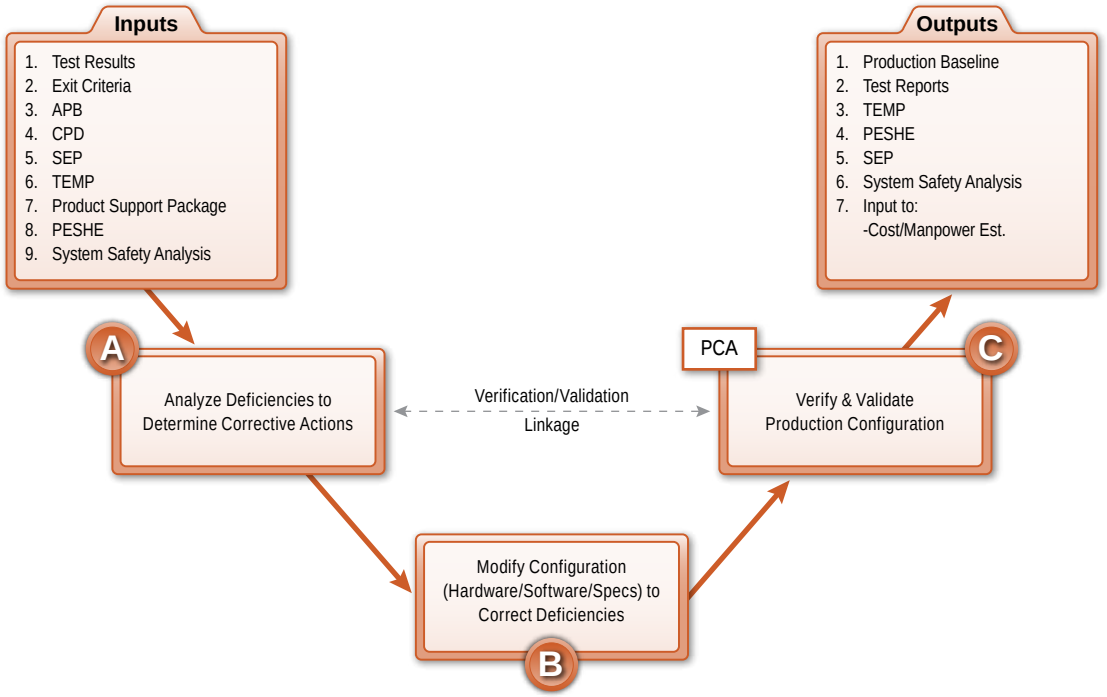
- Assess habitability risks against exit criteria for this acquisition phase
- Identify those habitability risks that could result in a breach to the program baseline or substantially impact cost, schedule, or performance

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.



Production and Deployment—The purpose of the Production and Deployment Phase is to achieve an operational capability that satisfies mission needs. Operational test and evaluation shall determine the effectiveness and suitability of the system. (DODI 5000.02)

Production & Deployment Phase

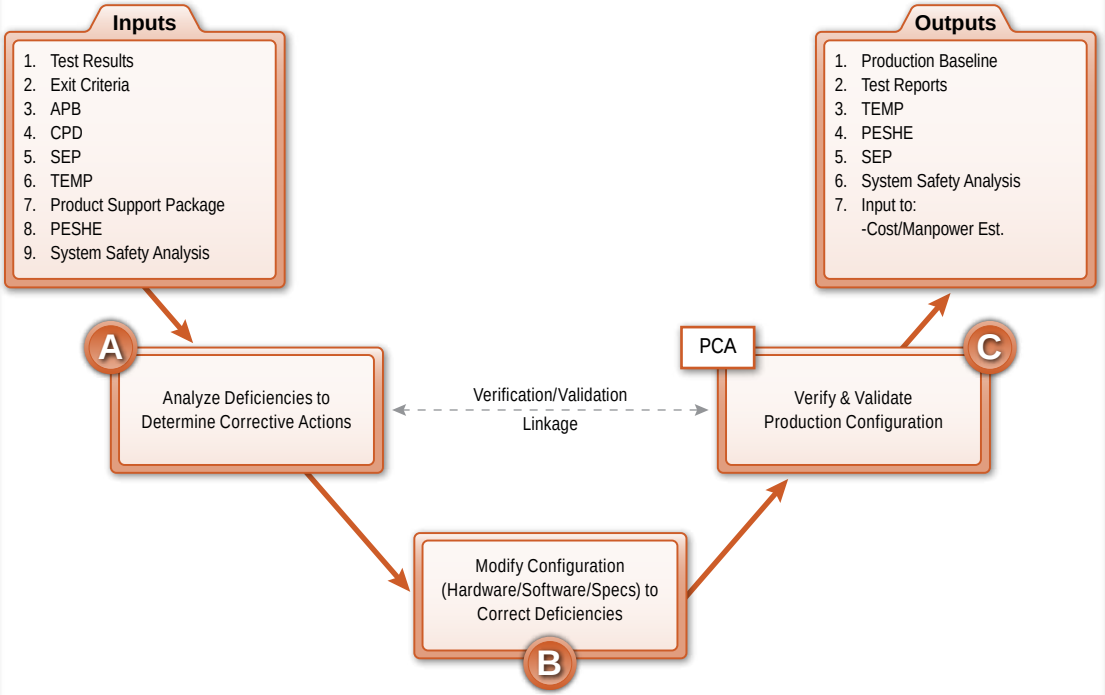


Production & Deployment Phase

Human Systems Integration

Activities for Each Input:

1.0 Review integrated system results and identify HSI concerns
1.1 Document results of HSI-specifc testing and identify planned corrective actions as appropriate
1.2 Leverage test results for HSI modifcations
2.0 Document risk control measures of identifed HSI constraints
3.0 Provide comprehensive HSI program inputs as required
4.0 Update HSI requirements and performance attributes to the system
5.0 Update strategy for incorporating HSI risk management into SE
5.1 Update HSIP with HSI-related concerns from operational test results
6.0 Monitor test planning to ensure HSI risk areas are being addressed
6.1 Revise to refect modifcations in HSI testing approach
7.0 Provide HSI updates to product support plans
8.0 Ensure inclusion of HSI risks and strategy for integration into SEP
9.0 Continue to monitor and track ongoing analysis results for HSI opportunities
9.1 Update with HSI inputs as required



Activities for Each Output:

1.0 Provide HSI updates based on Low Rate Initial Production (LRIP) and test results as required
2.0 Review test results for any HSI concerns and ensure appropriate corrective actions will be taken to address shortfalls.
2.1 Ensure trade-off decisions address HSI
3.0 Incorporate HSI-relevant data and further testing requirements
4.0 Coordinate with ESOH SME's for any required updates
4.1 Verify compliance with NEPA provisions
5.0 Update HSI risks and strategy for integration
5.1 Revise to refect changes in HSI data or strategies
6.0 Review and include HSI inputs as required
7.0 Revise MER to refect domain-specifc changes and impacts

References:

- DODI 5000.02 & DODD 5000.01
- DAG
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

Tools:

- IMPRINT

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Human Systems Integration

A

- Review defciency reports (DR) for HSI implications
- Participate in development of HSI mitigation measures
- Participate in Confguration Control Board (CCB) to include reviewing Engineering Change Proposals (ECPs) for HSI implications
- Analyze effectiveness of recommended NEPA/EO 12114 mitigation measures, and potential impacts on the natural environment
- Participate in planning of build, modifcation, verifcation, and test activities for the proposed design solution
- Assess the proposed design solution for correction of HSI defciencies

B

- Verify HSI system requirements and constraints at testing and training locations
- Identify HSI-critical design and verifcation requirements
- Provide HSI risk review and acceptance for upcoming test activities as appropriate
- Balance HSI recommendations with system cost, schedule, and performance risks

C

- Verify and validate HSI-critical design confguration
- Monitor testing and test results to validate HSI-relevant modifcations are effective
- Incorporate approved HSI changes that resolve HSI issues in the fnal production confguration baseline

PCA

- Ensure human concerns are accounted for with testing, measuring, and controlling within the system
- Ensure HSI concerns are adequately planned, tracked, and controlled when confrming the manufacturing processes, quality control system, measurement, test equipment, and training
- Ensure the procured data package matches the as-built confguration
- Identify hazardous materials and processes in the technical data package

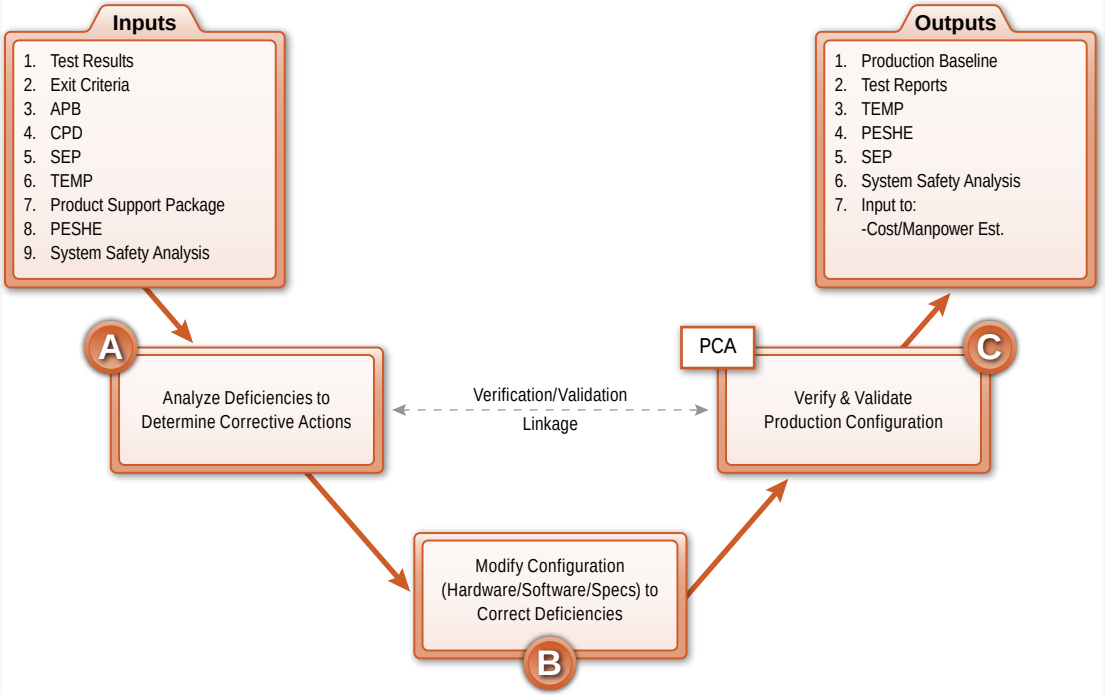
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Manpower

Activities for Each Input:

1.0 Review integrated system test results and identify manpower concerns
2.0 Develop manpower exit criteria, *e.g.,* ensure manpower authorizations are in place to support full operational capability
3.0 Provide manpower input to Program Plans (PPLANs) and POM
3.1 Develop manpower annex for Major Command (MAJCOM) PPLANs
3.2 Develop manpower annex for base implementation plans
4.0 Assess manpower impacts and provide input
5.0 Review SEP and provide manpower input incorporating the results of trade studies from the previous phase
6.0 Assess the TEMP for insight on tasks associated with the system
7.0 Estimate manpower requirements for the support options
8.0 Review and provide input as needed
9.0 Coordinate with system safety specialists to update manpower inputs to SSA



Activities for Each Output:

1.0 Ensure POM actions match unit cost of the production baseline
2.0 Review the reports and provide manpower inputs as needed
3.0 Prepare a consolidated list of tasks based on TEMP data
4.0 Review and provide input as needed
5.0 Provide manpower input to SEP
6.0 Assess safety issues for manpower impacts
7.0 Finalize the MER
7.1 Capture all required manpower data for use in future acquisitions
7.2 Develop manpower lessons learned and retain for future use
7.3 Retain manpower databases for use as BCS in future acquisitions
7.4 Prepare state-by-state manpower report input if necessary

References:

- AFI 38-201
- AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101
- AFMAN 63-119, Atch 9
- T.O. 00-35D-54

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- Discrete Event Simulation
- Micro Saint Sharp
- Job, Task, Function/Workload Analysis
- AFMSs
- LCOM, CHRIS, MPES
- TDFA, TSSA
- Manpower Typicals

Production and Deployment: Manpower

A

- Review DRs and assess manpower impacts
- Assess options and costs if manpower shortages are part of the problem
- Continue to participate in SATAFs to assess manpower impacts

B

- Apply base support manpower standards to assess beddown impacts if applicable
- Develop Manpower Authorization Change Requests (MACRs) for new manpower requirements and manpower changes if needed
- Continue to participate in SATAFs to assess manpower impacts

C

- Adjust POM and budget inputs as necessary to reflect production adjustments
- Continue to participate in SATAFs to assess manpower impacts

PCA

- Identify potential manpower implications if applicable
- Ensure approved manpower changes are incorporated into revised baselines, and production documentation

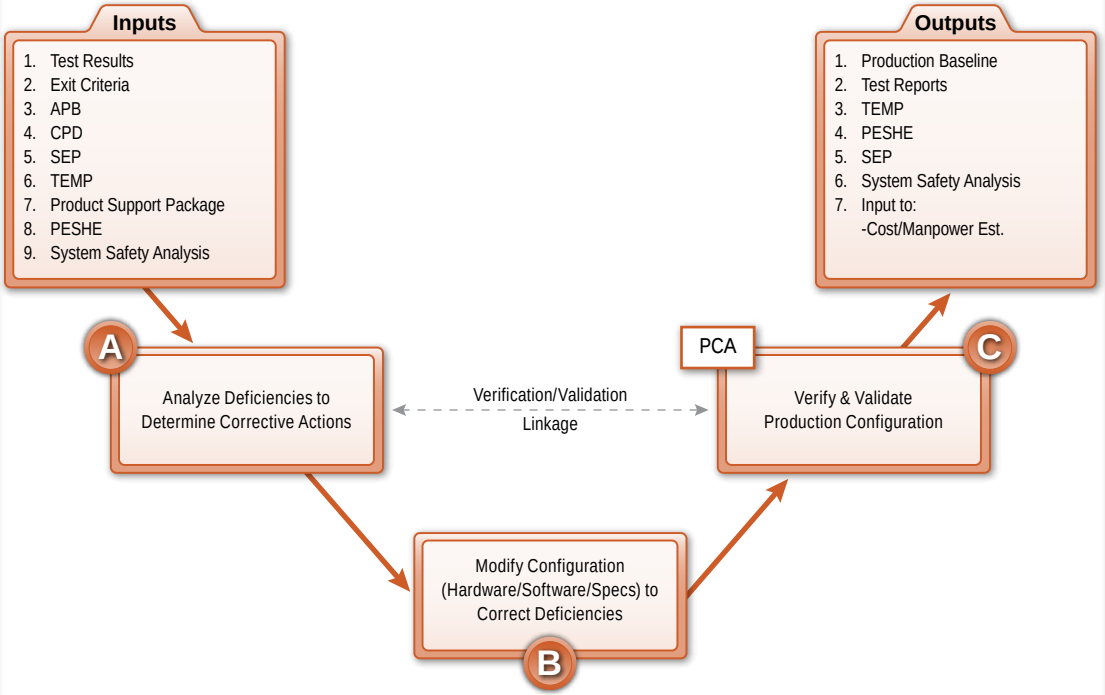
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Personnel

Activities for Each Input:

1.0 Review integrated system test results and identify personnel concerns
2.0 Develop personnel exit criteria
2.1 Develop personnel annex for MAJCOM PPLANs
2.2 Develop personnel annex for base implementation plans
3.0 Review and update POM inputs for personnel
3.1 Provide personnel input as needed
4.0 Assess personnel impacts and costs and provide input
5.0 Provide inputs as needed incorporating the results of trade studies from the previous phase
6.0 Assess the TEMP for insight on tasks associated with the system
7.0 Refne the TAD for the support options
7.1 Review overall training program for consistency with product support plan
8.0 Review and provide input as needed
9.0 Coordinate with system safety specialists to update personnel inputs to SSA



Activities for Each Output:

1.0 Ensure assignment and training actions correspond to the production schedule
1.1 Assess career feld impacts for personnel assignments
2.0 Review the reports and provide inputs as needed
3.0 Work with manpower POCs to prepare a consolidated list of tasks based on TEMP data
3.1 Use the task list to update AFSC descriptions and classifcation series
3.2 Assess the potential need for new AFSCs and/or new prefxes or suffxes for existing AFSCs
4.0 Review and provide input as needed
5.0 Provide inputs as needed
6.0 Assess safety issues for personnel impacts
7.0 Provide fnal MER input
7.1 Capture all required personnel data for use in future acquisitions
7.2 Develop personnel Lessons Learned and retain for future use
7.3 Retain personnel databases for use as BCS in future acquisitions

References:

- AFI 63-101 & AFMAN 63-119, Atch 9
- AFPD 36-14
- AFPD 36-21 & AFPD 36-22
- AFI 36-3802 & AFI 36-2623
- AFI 36-2305
- AFI 36-2101 & AFI 36-2110
- T.O. 00-35D-54

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Personnel

A

- Review DRs and assess personnel impacts
- Assess options and costs if personnel shortages or other personnel issues cause or exacerbate deficiencies
- Continue to participate in SATAFs to assess personnel impacts

B

- Examine base assignment ratios per career field to assess beddown impacts, if applicable
- Develop and coordinate personnel actions to correspond to new manpower requirements and manpower changes
- Continue to participate in SATAFs to assess personnel impacts

C

- Adjust budget, POM, and assignment inputs as necessary to reflect production/deployment adjustments
- Continue to participate in SATAFs

PCA

- Review PCA results to identify potential personnel implications
- Ensure approved personnel changes are incorporated into revised baselines, and production documentation

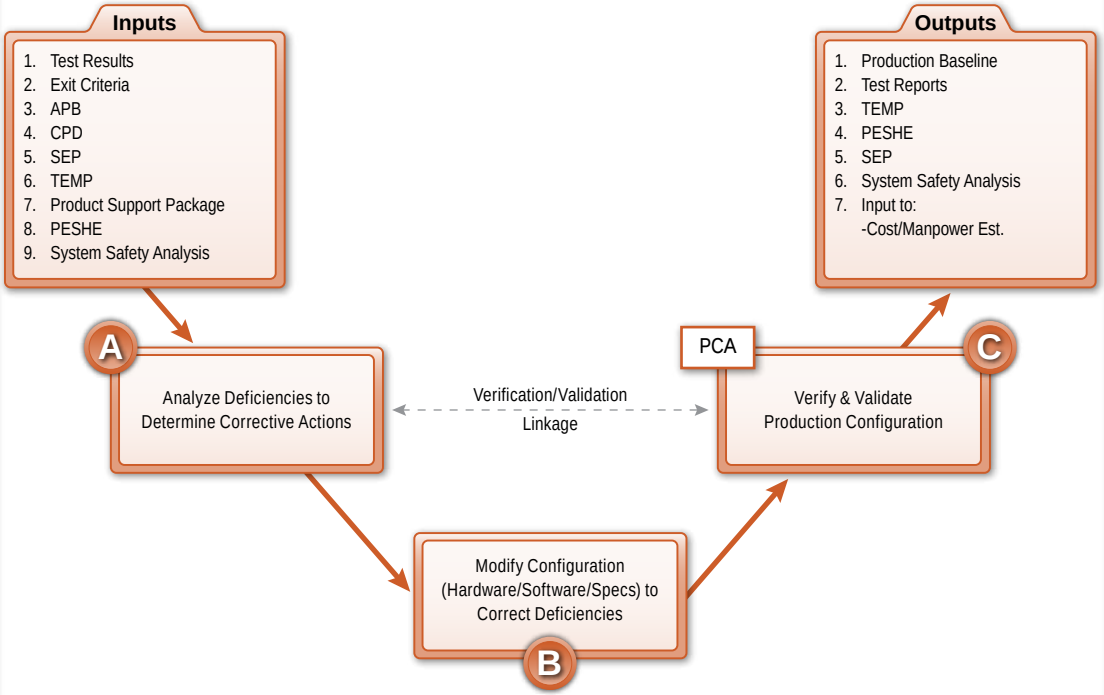
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Training

Activities for Each Input:

1.0 Review integrated system test results and identify training concerns
1.1 Review as part of the Utilization and Training Workshop (U&TW)
1.2 Incorporate user feedback in the U&TW
2.0 Develop training exit criteria
3.0 Review the APB and ensure it includes the latest training requirements estimates
4.0 Ensure personnel training schedules are in sync with the CPD schedule
4.1 If applicable, ensure the schedule for acquiring training systems, to include trainers/ simulators, is in sync with the CPD schedule
4.2 Ensure any new/renovated physical facilities to support training are ready for deployment of the system
5.0 Identify responsibilities for training integration into SE
6.0 Identify test scenarios for assessing training
6.1 Ensure testing of training objectives is included in the TEMP
7.0 Identify training requirements for operations and maintenance
7.1 Identify any other functional training requirements for support
8.0 Provide input as needed
9.0 Coordinate with system safety specialists to update training inputs to SSA



Activities for Each Output:

1.0 Ensure training requirements are included
2.0 Review and identify additional training requirements if needed
3.0 Assess the testing results from training scenarios
4.0 Provide input as needed
5.0 Ensure training responsibilities are included
6.0 Review and provide inputs as needed
7.0 Ensure training costs are included

References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3
- AFMAN 36-2234
- AFPD 36-22

Tools:

- HPAT
- ADVISOR
- AIM

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Training

A

- Assess deficiencies for potential training issues
- Ensure the most effective training method is being used
- Identify changes to training requirements as necessary to resolve deficiencies
- Conduct a U&TW to develop new training procedures and documents

B

- Adapt training approaches and materials as needed to meet new configurations
- Update training requirements and cost estimates as needed

C

- Assess the revised training materials
- Ensure the adjustments are effective and correct the earlier deficiencies
- Look for potential unintended consequences from the training adjustments
- Review and revise the training schedule as needed to account for the configuration changes

PCA

- Review the technical configuration and identify any training issues
- Ensure approved training changes are incorporated into revised baselines, and production documentation

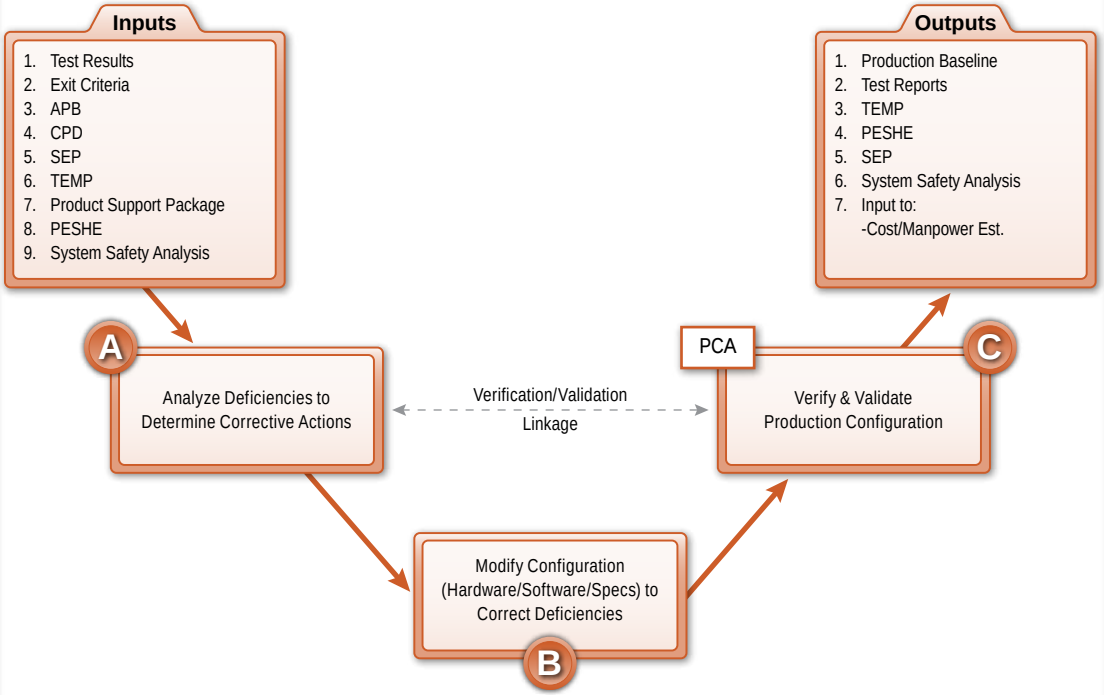
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Human Factors Engineering

Activities for Each Input:

1.0 Review integrated system test results and identify HFE concerns
1.1 Verify risk mitigation measures to reduce HFE risks
1.2 Review HFE test results for the user issues that have arisen
1.3 Verify mitigation control measures to reduce HFE risks effectively
1.4 Analyze limitations, attributes and HMI
2.0 Document justifcations and mitigations of identifed HFE issues
2.1 Obtain concurrence/approval of appropriate HFE working groups
3.0 Provide inputs as needed
3.1 Identify HFE critical items and processes
4.0 Update HFE requirements and performance attributes for the system
4.1 Provide inputs to trade space discussions that affect HFE
5.0 Update HSIP as required
5.1 Update strategy for HFE integration into SE
6.0 Update specifc user testing requirements
6.1 Update specifc HFE verifcation strategies
6.2 Validate HFE specifc policy and guidance
7.0 Review for HFE impacts
8.0 Provide inputs as required
9.0 Coordinate with system safety specialists to update HFE inputs to SSA



Activities for Each Output:

1.0 Input updates to all program documentation
2.0 Review OT&E results for the effectiveness of HFE risk mitigation controls
2.1 Document effectiveness of risk mitigation controls and NEPA/EO 12114 mitigation measures and fndings from anomalies, incidents and mishaps
3.0 Update HFE issue verifcation strategies
4.0 Update PESHE to include identifed HFE risks and strategy for SEP integration
4.1 Identify applicable working groups and processes for concurrence
5.0 Update strategy for integrating HFE into SEP
6.0 Finalize HFE hazard analyses
7.0 Recommend training and staffng requirements
7.1 Update system attrition rate input due to mishaps

References:

- AFI 63-101 & AFI 63-1201
- MIL-STD-1295A
- MIL-STD-1472 & MIL-STD-1478
- MIL-HDBK-743A
- MIL-HDBK-46855

Tools:

- ACT-R
- ErgoMaster, ErgoImager, ErgoWeb JET
- DeSAT
- SAGAT
- VACP

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Human Factors Engineering

A

- Review DRs for HFE implications
- Participate in development of HFE mitigation control measures
- Participate in CCB to include reviewing ECPs
- Analyze effectiveness of recommended NEPA/EO 12114 mitigation measures, and potential impacts on the natural environment
- Participate in plans to build, modify, verify, and test the proposed design solution and test the proposed design solution for correcting deficiencies

B

- Verify HFE system requirements and constraints at testing and training locations
- Identify HFE critical design and verification requirements
- Provide HFE risk review and acceptance for upcoming test activities as appropriate
- Balance HFE recommendations with system cost, schedule, and performance risks
- Provide updated HFE input for demilitarization/disposal planning

C

- Verify and validate HFE critical design configuration
- Participate in test activities as appropriate
- Incorporate approved HFE changes in final production configuration baseline

PCA

- Review PCA to identify potential HFE implications
- Ensure approved HFE changes are incorporated into revised baselines and production documentation

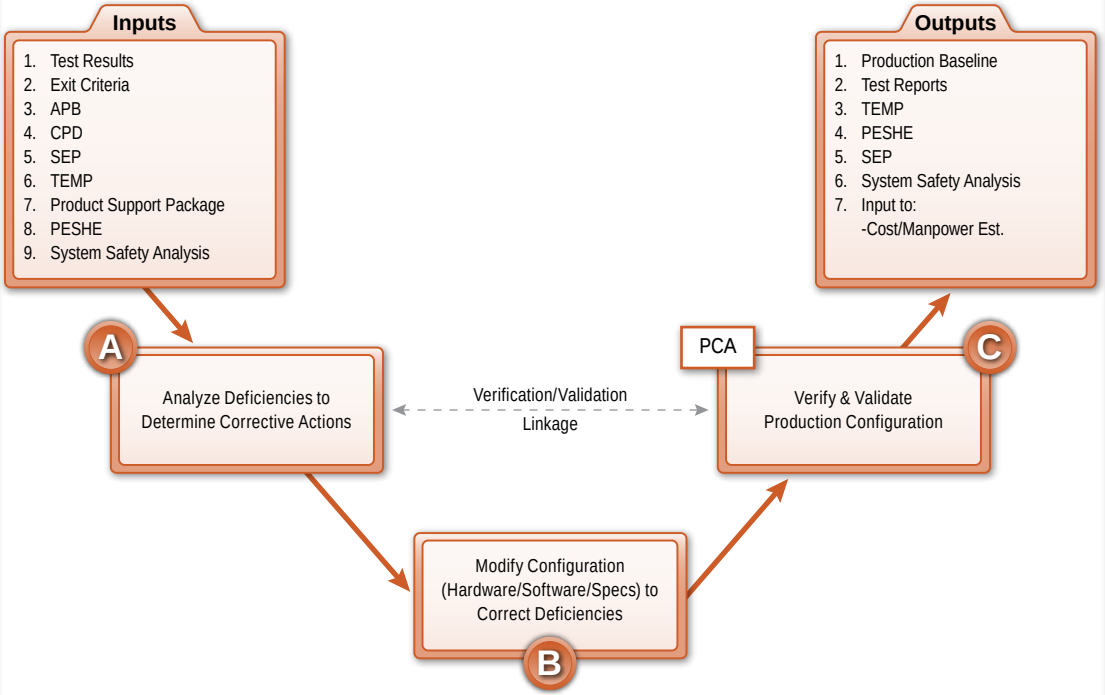
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Survivability

Activities for Each Input:

1.0 Review integrated system test results and identify Sv concerns
1.1 Analyze anomalies, incidents, and mishaps
2.0 Document risk control measures of identifed Sv limitations
3.0 Update Sv considerations and criteria
4.0 Update Sv requirements and performance attributes for the system
5.0 Update strategy for integrating Sv risk management into SEP
6.0 Update specifc test and safety release requirements for verifcation of risk mitigation measures
7.0 Include system safety and hazard analysis results (*e.g.*, O&SHA)
8.0 Ensure PESHE includes identifed Sv risks and strategy for integrating into SEP
8.1 Identify applicable working groups for concurrence
9.0 Coordinate with system safety specialists to update Sv inputs to SSA



Activities for Each Output:

1.0 Identify Sv-critical items and processes
1.1 Specify inspection requirements
1.2 Document concurrence of applicable working groups
2.0 Document effectiveness of risk mitigation controls from anomalies, incidents and mishaps
3.0 Update specifc test and Sv capability verifcation strategies and include risk control measures
3.1 Complete all LFT&E testing
4.0 Update PESHE to include identifed Sv risks and strategy for integrating into the SEP
4.1 Identify applicable working groups and processes for concurrence
5.0 Update strategy for integrating Sv risk management into SEP
6.0 Finalize hazard analyses
7.0 Recommend training and staffng requirements
7.1 Update system attrition rate input due to mishaps

References:

- DODD 5000.01
- DODI 5000.02
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1201
- AFMAN 63-119
- 10 USC 2366

Tools:

- None specifcally linked to this phase

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Survivability

A

- Review DRs for Sv implications
- Participate in development of Sv mitigation control measures
- Participate in CCB to include reviewing ECPs
- Complete assessment of how well Sv objectives have been met and include results in the Beyond Low-Rate Initial Production Report

B

- Verify Sv requirements and constraints at testing and training locations
- Identify Sv-critical design and verification requirements
- Provide Sv risk review and acceptance for upcoming test activities as appropriate
- Balance Sv recommendations with system cost, schedule, and performance risks
- Include Sv considerations in major modification or upgrade packages; address possibility of retrofitting Sv into system

C

- Verify and validate Sv-critical item configuration
- Participate in test activities as appropriate

PCA

- Review PCA to identify potential Sv implications
- Ensure approved Sv changes are incorporated into revised baselines, and production documentation

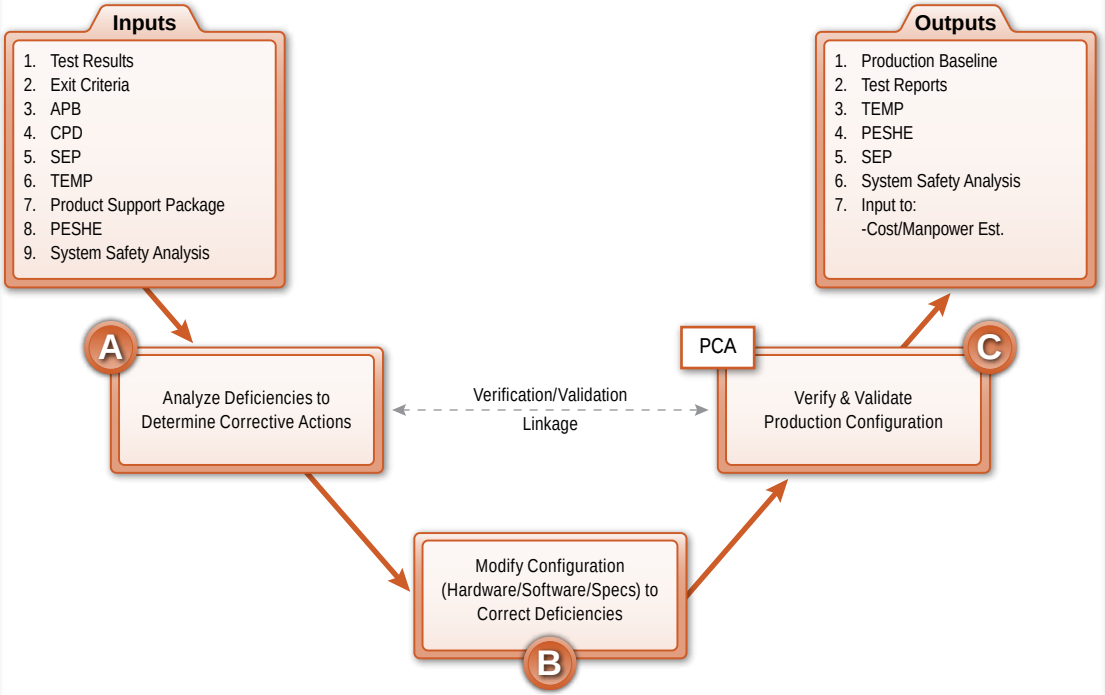
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Environment

Activities for Each Input:

1.0 Review integrated system test results and identify environment concerns
1.1 Analyze environment anomalies and incidents
2.0 Document formal risk disposition of identifed environment hazards
2.1 Identify environment exit criteria
3.0 Update environment considerations and criteria
4.0 Update environment requirements and performance attributes for the system
5.0 Update environment hazards and risks integration strategy into SE
6.0 Update specifc test and safety release requirements
6.1 Verify environment risk mitigation control requirements
7.0 Include hazard analysis results (*e.g.*, O&SHA) and other environment support resources
8.0 Include identifed environment risks and strategy for integration into SE, environment hazard tracking and risk mitigation
8.1 Ensure environment issues are adequately resourced
9.0 Complete ESOH hazard and risk analysis (*e.g.*, SRCA, SSHAs, SHA, and O&SHA)



Activities for Each Output:

1.0 Identify environment critical items and processes
1.1 Specify inspection requirements
2.0 Document effectiveness of risk mitigation controls, fndings from anomalies and incidents
3.0 Update specifc test and safety release requirements for risk control verifcation
3.1 Review any environment-related modifcations based on test results
4.0 Update PESHE to include identifed environment risks, strategy for integration into SE, and hazard tracking methods
4.1 Ensure there are adequate resources to continue to track, identify, and manage environment hazards and risk
5.0 Update environment risk management strategy for SE
6.0 Finalize hazard analyses
7.0 Recommend training and staffng requirements for environment

References:

- NEPA/EO 12114
- DODI 5000.02 & DODI 4715.4
- MIL-STD-882D & MIL-STD-1425A
- MIL-STD 1472 & MIL-STD-1474D
- AFI 63-1201 & AFI 32-7086
- NAS 411: HMMP

Tools:

- PESHE Checklist
- ESOH Programmatic Risk Assessment Toolset
- HMIRS

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Environment

A

- Review DRs for environment implications
- Participate in development of hazard mitigation control measures
- Participate in CCB to include reviewing ECPs
- Participate in plans to build, modify, verify, and test the proposed design solution for correcting deficiencies
- Verify environment requirements at testing, basing, and training locations

B

- Identify environment-critical items and inspection and verification requirements
- Review and recommend updates to TEMP based on environment analyses, and provide environment release documentation
- Provide hazard risk review and acceptance for upcoming test activities

C

- Verify and validate environment-critical design elements
- Participate in test activities
- Incorporate approved environment changes and risk mitigation techniques in final production configuration baseline

PCA

- Identify potential environment implications from system configuration
- Validate all processes that have environment-critical functions
- Ensure approved environment changes are incorporated into revised baselines, and production documentation

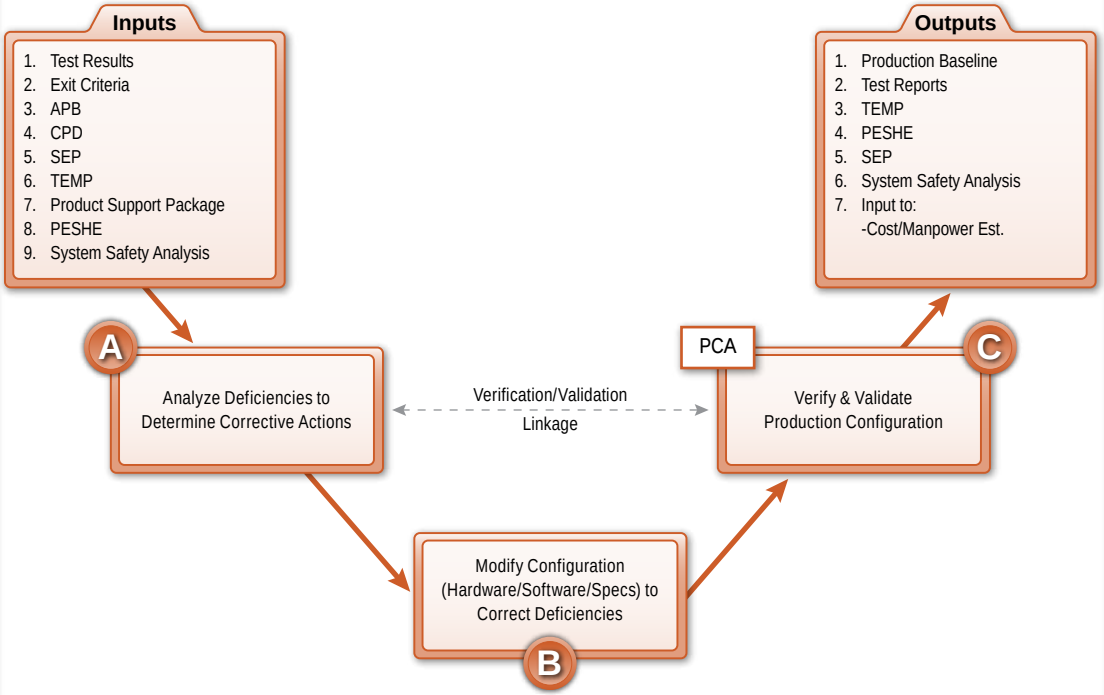
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Safety

Activities for Each Input:

1.0 Review integrated system test results and identify safety concerns
1.1 Analyze anomalies, incidents and mishaps
2.0 Document formal risk disposition of identifed hazards
2.1 Update PESHE and other exit criteria documentation
2.2 Document concerns with demilitarization/ disposal safety strategies
3.0 Incorporate system mishap prevention and safety thresholds
4.0 Update system and operator safety requirements and performance attributes
5.0 Update hazard and risk mitigation strategies
6.0 Update specifc test and safety release requirements and risk mitigation control requirements
7.0 Include safety analysis results (*e.g.*, O&SHA) and other safety resources
8.0 Revise to refect safety risks, SE integration strategies, and hazard tracking methodology
8.1 Identify applicable safety boards and processes for approval/ concurrence
9.0 Complete ESOH hazard and risk analysis (*e.g.*, SRCA, SSHAs, SHA, and O&SHA)



Activities for Each Output:

1.0 Track critical system safety items and processes
1.1 Monitor inspection requirements
1.2 Document concurrence/approval of applicable safety boards
2.0 Document effectiveness of risk mitigation controls, fndings from anomalies, incidents, and mishaps from developmental and operational testing
3.0 Update specifc test and safety release requirements and verify risk mitigation measures
3.1 Monitor safety design effectiveness for unexpected hazards during testing
4.0 Update PESHE to include identifed system safety and hazard risks, strategy for integration into SE, system safety responsibilities and hazard tracking methods
4.1 Ensure there are resources to continue to track, identify, and manage safety hazards and associated risks
5.0 Update strategy for integrating hazard risk management into SE
6.0 Finalize hazards analyses
7.0 Recommend training and staffng requirements for sustainable safe operation and maintenance
7.1 Update system attrition rate inputs

References:

- MIL-STD-882D
- DAG
- DoD System Safety Handbook
- AFI 63-1201
- AFI 63-101
- AFPD 90-8
- AFI 91 Series

Tools:

- ESOH Programmatic Risk Assessment Toolset
- 3D System Safety Engineering Analysis
- HMIRS, AFSAS, HFACS, HFIX
- RiskSafe 7
- ASAP

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Safety

A

- Participate in DR boards for safety implications
- Participate in development of hazard mitigation control measures
- Participate in CCB to include reviewing ECPs
- Participate in plans to build, modify, verify, and test the proposed design solution for correcting deficiencies
- Verify safety design requirements at testing, basing, and training locations

B

- Identify safety-critical designs and inspection verification requirements
- Review and recommend updates to TEMP based on system safety analyses, and provide safety release documentation
- Provide hazard risk review and acceptance for upcoming test activities

C

- Verify and validate safety-critical design configuration
- Participate in test activities
- Incorporate approved safety changes and risk mitigation measures in final production configuration baseline

PCA

- Identify potential safety implications from system configuration
- Validate all critical safety functions and processes
- Identify and document any HAZMAT from engineering and production drawings
- Ensure approved safety changes are incorporated into revised baselines, and production documentation

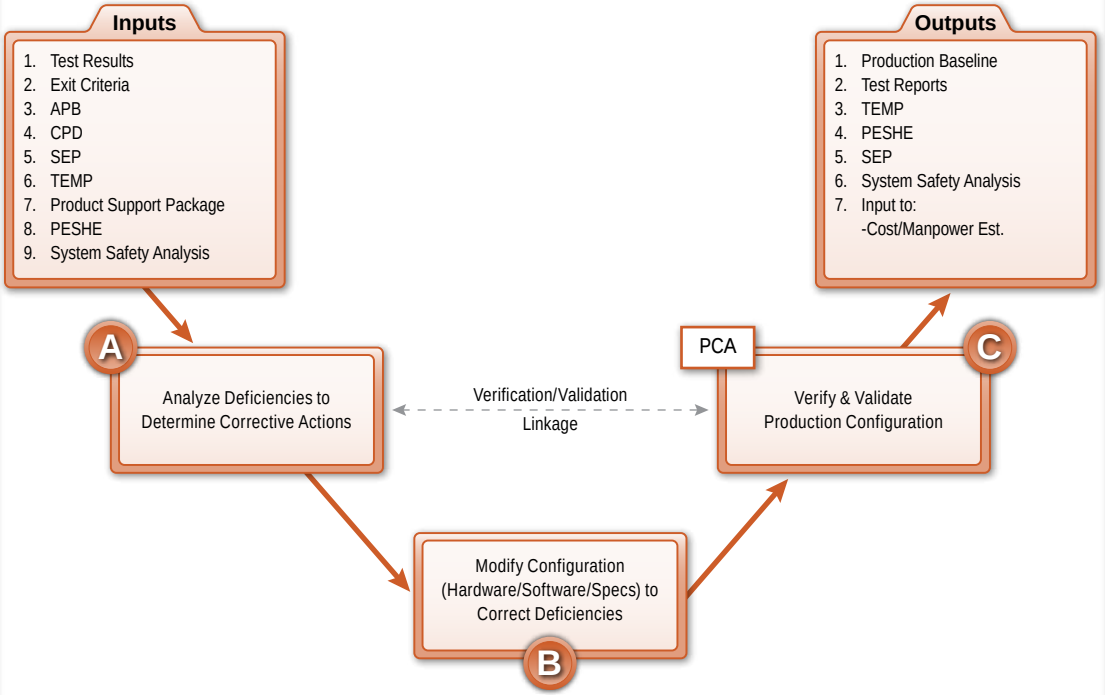
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Occupational Health

Activities for Each Input:

1.0 Review integrated system test results and identify OH concerns
1.1 Analyze OH anomalies and incidents
2.0 Document formal risk disposition of identifed OH hazards
2.1 Update PESHE and other exit criteria documentation
3.0 Update OH considerations and criteria
4.0 Update OH requirements and performance attributes for the system
5.0 Update hazard and risk mitigation strategies
6.0 Update specifc test and OH release requirements and verifcation of risk mitigation control requirements for OH
7.0 Include hazard analysis results (*e.g.*, O&SHA) and other OH support resources
8.0 Include identifed OH risks and strategy for integration into SE, OH hazard tracking, and risk mitigation
9.0 Complete ESOH hazard and risk analysis (*e.g.*, SRCA, SSHA, SHA, and O&SHA)



Activities for Each Output:

1.0 Identify OH critical items and processes
1.1 Specify inspection requirements
2.0 Document effectiveness of risk mitigation controls, fndings from anomalies, and incidents
3.0 Update specifc test and OH release requirements for risk control verifcation
3.1 Review any OH related modifcations based on test results
4.0 Update PESHE to include identifed OH risks, strategy for integration into SE, and hazard tracking methods
4.1 Ensure resources are available to continue to track, identify, and manage OH hazards and risk
5.0 Update OH risk management strategy for SE
6.0 Finalize hazard analyses
7.0 Recommend training and staffng requirements for OH

References:

- MIL-STD-882D
- DoD System Safety Handbook
- DODI 6055.05
- AFI 32-7086
- AFI 63-1201 & AFI 63-101
- AFPD 90-8

Tools:

- CARE
- DOORS
- HMIRS
- ESOH Programmatic Risk Assessment Toolset
- PESHE Checklist
- BEE

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Occupational Health

A

- Review DRs for OH implications
- Participate in development of hazard mitigation control measures
- Participate in CCB to include reviewing ECPs
- Participate in plans to build, modify, verify, and test the proposed design solution for correcting deficiencies
- Verify OH requirements at testing, basing, and training locations

B

- Identify OH-critical items and inspection and verification requirements
- Review and recommend updates to TEMP based on OH analyses, and provide safety release documentation
- Provide hazard risk review and acceptance for upcoming test activities

C

- Verify and validate OH-critical design elements
- Participate in test activities
- Incorporate approved OH changes and risk mitigation techniques in final production configuration baseline

PCA

- Identify potential OH implications from system configuration
- Validate all processes that have OH critical functions
- Update any HAZMAT from engineering and production drawings
- Ensure approved OH changes are incorporated into revised baselines, and production documentation

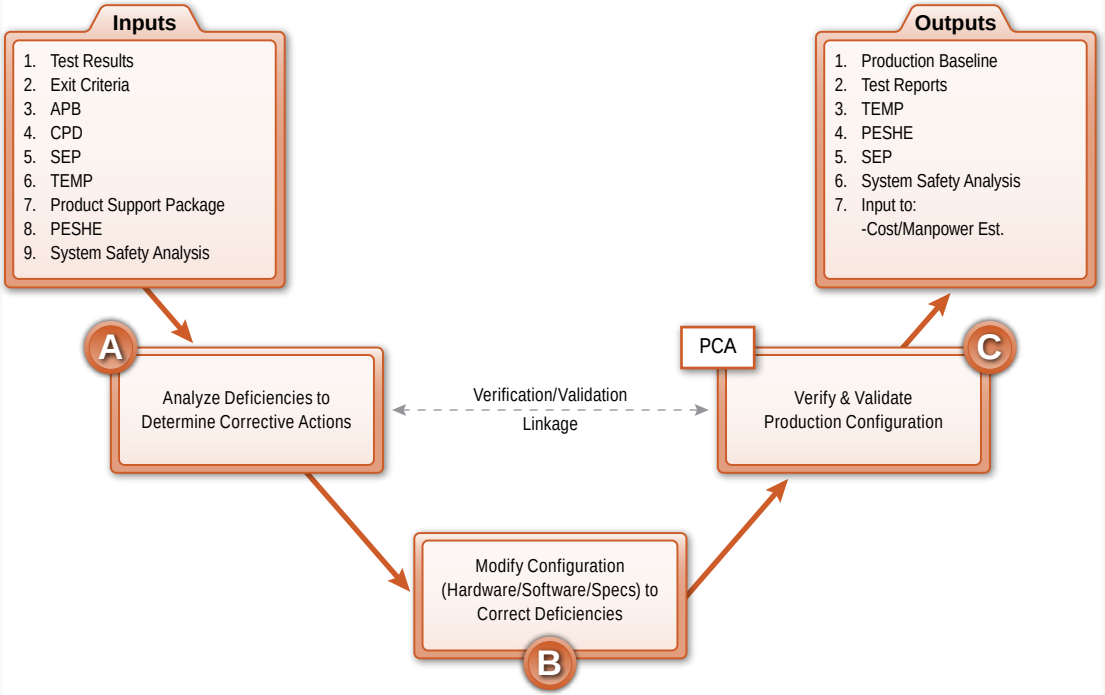
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Production & Deployment Phase

Habitability

Activities for Each Input:

1.0 Review integrated system test results and identify habitability concerns
2.0 Determine progress against habitability risk areas
2.1 Obtain concurrence of HFE and safety working groups
3.0 Provide inputs as required
4.0 Provide inputs as required
5.0 Provide habitability updates to HSIP
5.1 Update strategy for habitability integration into SE
6.0 Update habitability test strategies as required based on DT&E test results
6.1 Ensure habitability requirements are addressed in test documentation
7.0 Review the product support package for habitability impacts
8.0 Coordinate with ESOH specialists to update habitability inputs to PESHE
9.0 Coordinate with system safety specialists to update habitability inputs to SSA



Activities for Each Output:

1.0 Verify that habitability characteristics have been addressed in the CIs in the initial product baseline
2.0 Review test results for habitability implications
2.1 Ensure results are documented for habitability-specifc testing
3.0 Ensure top-level habitability test strategies are documented in the TEMP
4.0 Coordinate with ESOH specialists to determine which habitability considerations have been addressed in the PESHE
5.0 Update habitability inputs to the HSIP in the SEP
6.0 Coordinate with safety specialists to determine if habitability considerations that impact safety have been included
7.0 Coordinate manpower inputs with potential habitability constraints
7.1 Provide habitability inputs to life-cycle cost estimates

References:

- NASA-STD-3001 Vol II
- DODI 5000.02 & DAG
- AFI 63-101
- T.O. 00-35D-54

Tools:

- NHV
- Index of Habitability
- Scale mockups
- Anthropometry measurements

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Production and Deployment: Habitability

A

- Review test reports, DRs and mockup results to determine root causes, impacts and severity
- Collect additional data and solicit feedback as required
- Propose corrective action and validate potential corrective actions
- Participate in trade-off analyses as required

B

- Participate in change management process as required

C

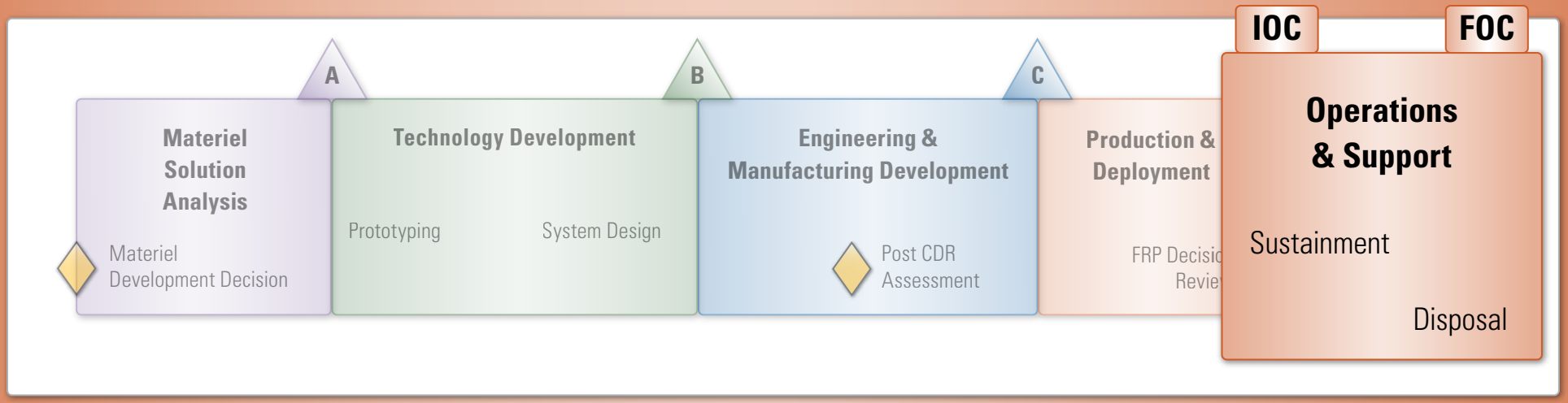
- Participate in change validation activities
- Ensure approved habitability changes are incorporated into revised CI baselines

PCA

- Ensure approved habitability changes are incorporated into revised baselines and production documentation

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

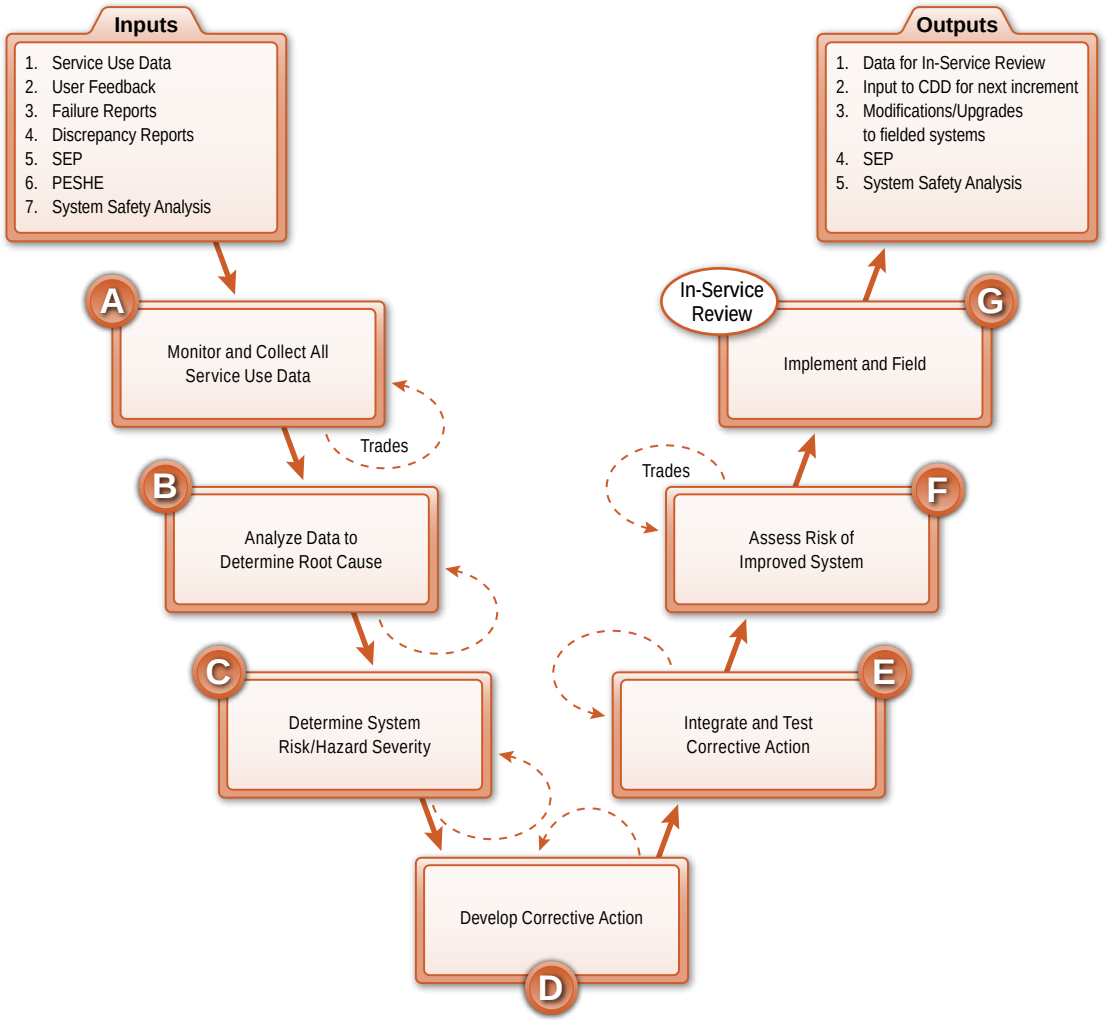
<< Back



Operations and Support—The purpose of the Operations and Support Phase is to execute a support program that meets materiel readiness and operational support performance requirements, and sustains the system in the most cost-effective manner over its total life cycle. Operations and Support has two major efforts, Life-Cycle Sustainment and Disposal. (DODI 5000.02)

<< Back

Operations & Support Phase

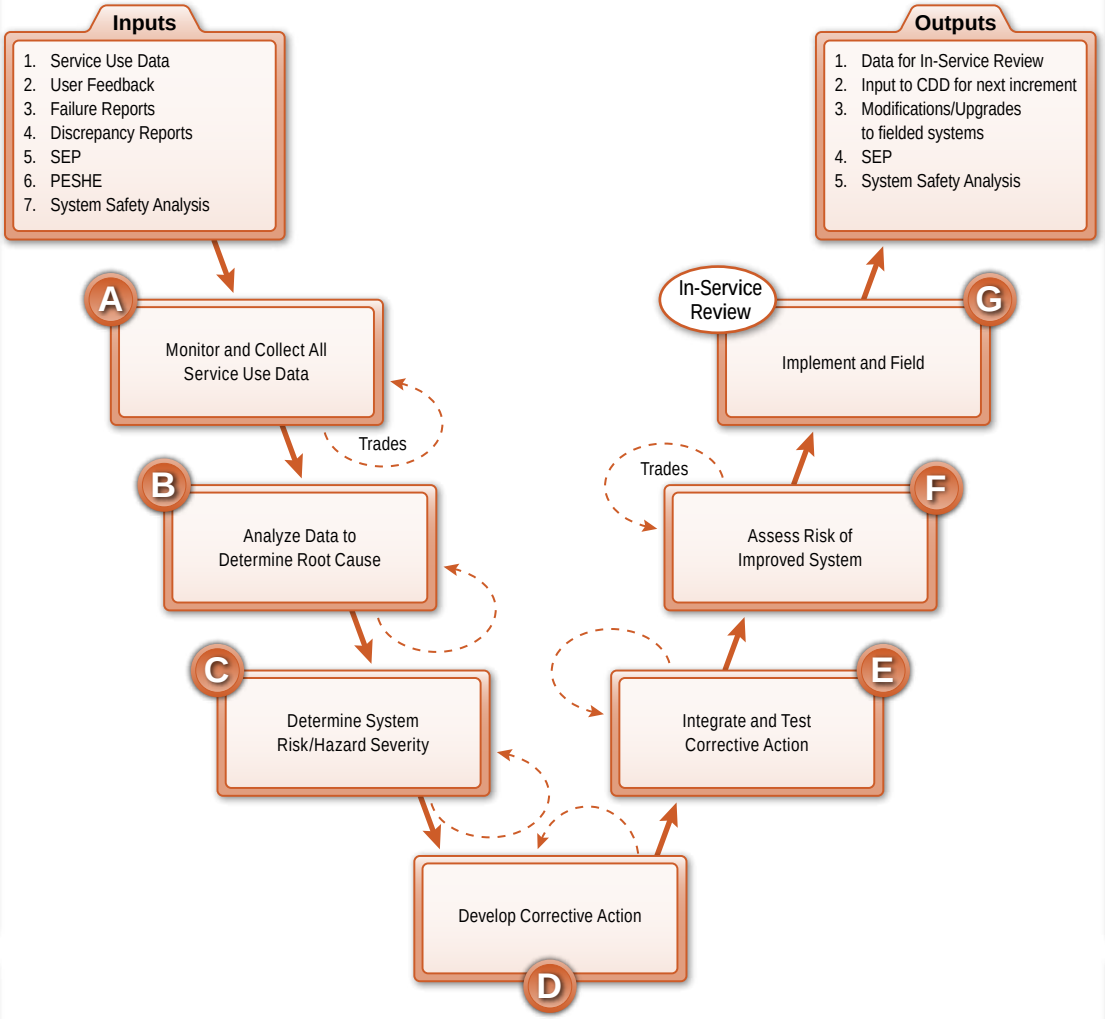


Operations & Support Phase

Human Systems Integration

Activities for Each Input:

1.0 Review HSI-related incident and mishap data reports
1.1 Identify HSI-related maintenance issues
1.2 Provide HSI inputs and constraints to system modifcations
2.0 Solicit user inputs to identify HSI issues
2.1 Participate in system HSI working groups to highlight HSI opportunities
3.0 Review HSI-related incident and mishap data reports
3.1 Ensure domain SMEs review relevant reports
4.0 Review and analyze for HSI issues
4.1 Provide HSI inputs to trade-off analysis
5.0 Update strategy for merging HSI risk management into SE
5.1 Update HSIP
6.0 Ensure inclusion of HSI risks and strategy for incorporation into PESHE
7.0 Revise HSI data and analysis results



The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Activities for Each Output:

1.0 Update HSI risk assessment
1.1 Review HSI hazards and DRs from operations and maintenance
2.0 Document achievable HSI requirements for each incremental stage
2.1 Include HSI inputs as needed
3.0 Incorporate HSI analyses, impacts, and defciency data
4.0 Review and update
4.1 Add any modifcations and technology developments that are HSI-related
5.0 Revise to refect domain-specifc changes as required

References:

- DODI 5000.02 & DODD 5000.01
- DAG
- CJCSI 3170.01
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1101
- AFI 63-1201
- Domain-specifc policies

Tools:

- IMPRINT

Operations and Support: Human Systems Integration

A

- Provide system HSI criteria to engineering and logistics staff
- Review data for HSI-influenced hazards (*e.g.,* trend analysis)
- Identify opportunities for technology insertion to reduce HSI risks
- Analyze rates for Class A, B, and C mishaps for the system and subsystems for HSI causal factors
- Review technical data change requests that may impact HSI

B

- Apply appropriate System Safety Analysis techniques to determine if HSI root causal factors exist
- Evaluate data for HSI implications
- Revise system's hazard analysis and risk tracking systems. Modify system status reports to reflect HSI impacts

C

- Prioritize HSI-related hazards for risk mitigation
- Revise system's hazard analysis and risk tracking systems. Modify system status reports to reflect HSI impacts

D

- Apply system safety order of precedence to HSI corrective actions
- Revise system's hazard analysis and risk tracking systems. Modify system status reports to reflect HSI impacts
- Identify requirements for verification of HSI mitigation control measures

E

- Evaluate test results for risk mitigation effectiveness
- Ensure control measures do not introduce latent problems into other domains, systems, human performance, or processes
- Revise system's hazard analysis and risk tracking systems. Modify system status reports to reflect HSI impacts

F

- Conduct in-depth system analyses to ensure corrective measures and design modifications do not spawn additional deficiencies or degrade human performance
- Recommend deficiency closure to appropriate risk acceptance authorities (updated residual risk)
- Revise system's hazard analysis and risk tracking systems. Modify system status reports to reflect HSI impacts

G

- Continue to monitor and track system health, human performance indicators, mishaps, deficiencies, closure actions, mitigation measure effectiveness, and residual risk to validate enhancement efforts

In-Service Review

- Ensure that HSI considerations are included during the risk, operational readiness, technical status, and trends assessments in a measurable form
- Substantiate assessments with in-service support budget priorities
- Include System Safety Working Group to support the System Hazard Risk Assessment
- Review and update problem-reporting metrics

Trades

- As corrective actions are incorporated into the system, HSI considerations that affect the system should be part of the decision making and trade studies that occur
- Utilize HSI analysis to influence maintenance and modification trade-off decisions
- Participate in HSI-critical trade studies and review results of all trade studies

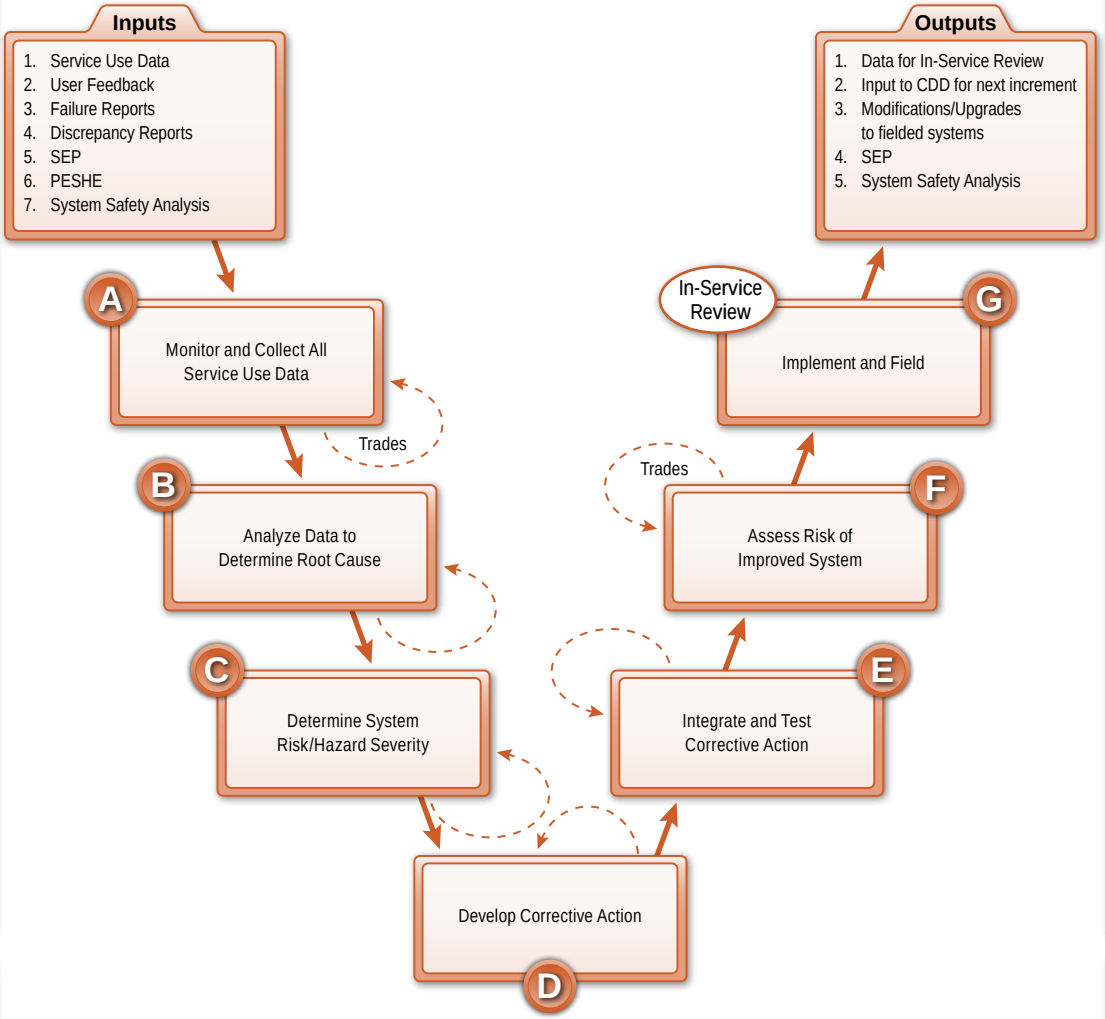
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Manpower

Activities for Each Input:

1.0 Apply manpower standards
2.0 Conduct operational audits and update applicable manpower standards
2.1 Develop variances to manpower standards if needed
3.0 Monitor failure reports for potential manpower impacts
4.0 Monitor DRs for potential manpower impacts
5.0 Incorporate manpower inputs as needed
6.0 Coordinate with ESOH specialists to determine that manpower considerations have been addressed for any system modifcations
7.0 Assess safety issues for potential manpower impacts



Activities for Each Output:

1.0 Collect in-service workload data
2.0 Provide manpower input for next increment
2.1 Adjust POM or MACRs as needed to match next increment
3.0 Apply AFMSs for fielded systems
3.1 Prepare MACRs if adjustments are needed
3.2 Develop variances to manpower standards to account for the modifcations if needed
4.0 Provide manpower input
5.0 Assess safety issues for potential manpower impacts

References:

- AFI 38-201
- AFI 38-204
- AFMAN 38-208 V1, V2 & V3
- AFI 63-101
- AFMAN 63-119, Atch 9
- T.O. 00-35D-54

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- Discrete Event Simulation
- Micro Saint Sharp
- Job, Task, Function/Workload Analysis
- AFMSs, TDFA, TSSA
- LCOM, CHRIS, MPES
- Manpower Typicals

Operations and Support: Manpower

A
- Review maintenance data for anomalies

B
- Provide manpower input as needed to analyze root issues

C
- Assess manpower impacts associated with system risks and/or hazards

D
- Assess manpower impact(s) of proposed changes
- POM for additional manpower if required
- Prepare MACRs to adjust manpower baseline

E
- Assess manpower impact(s) of proposed changes
- POM for additional manpower if required
- Prepare MACRs to adjust manpower baseline

F
- Continue to participate in SATAFs to assess manpower impacts if applicable
- Prepare MACRs to adjust manpower baseline

G
- Revise AFMS and/or LCOM scenario to reflect process and equipment changes
- Update process-oriented descriptions
- Develop variances as needed
- Assess manpower status for excess overtime or idle time
- Reapply AFMSs based on actual data
- Prepare MACRs to adjust manpower baseline

In-Service Review
- Solicit user feedback against known manpower risk areas and update manpower risks for fielded systems as required

Trades
- Assess manpower costs of proposed alternatives
- Advise on resource availability and options to support alternatives
- Present manpower impacts for trade analyses as required
- Provide manpower inputs to proposed modifications and upgrades
- Coordinate with other domain POCs as required

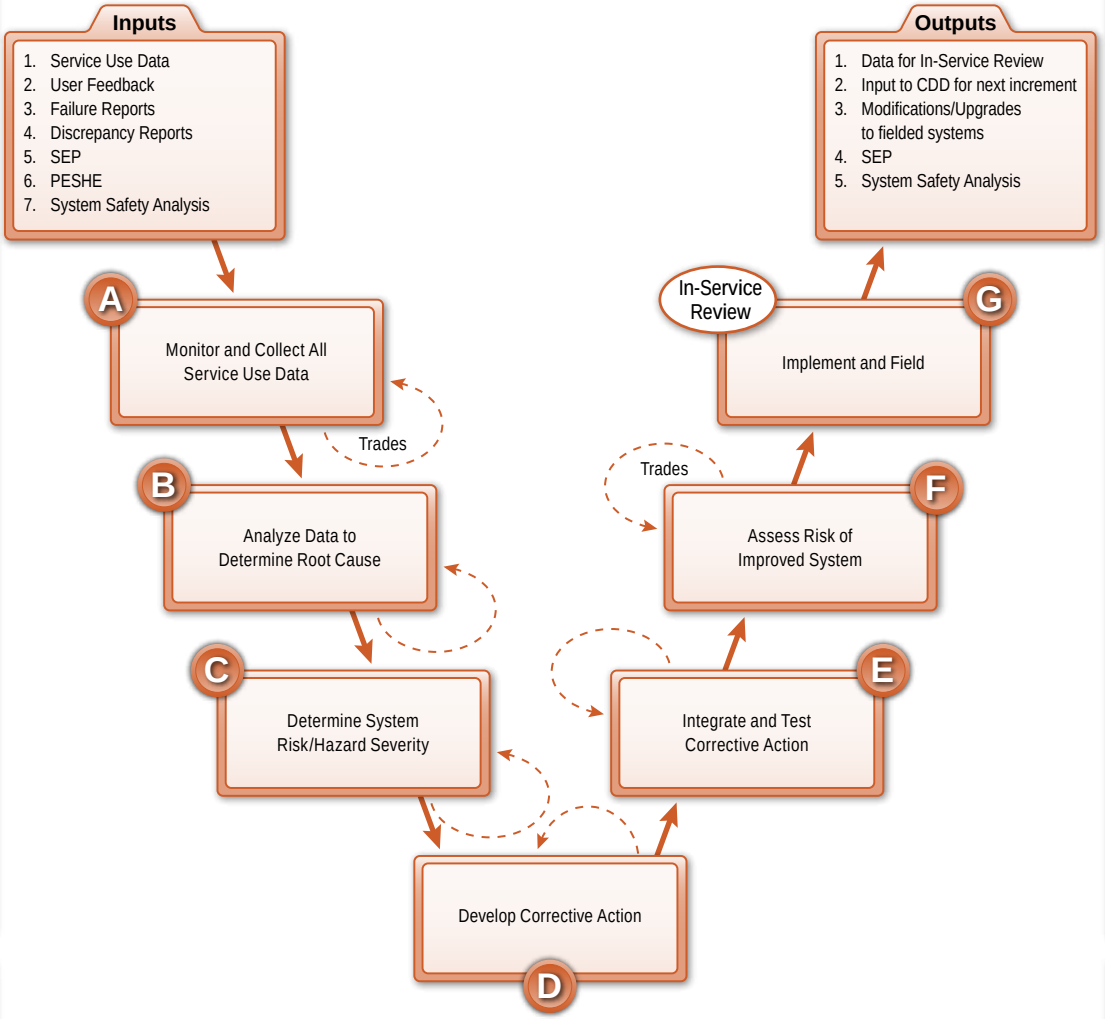
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Personnel

Activities for Each Input:

1.0 Coordinate on any manpower changes driven by service use data and the application of manpower standards
2.0 Review and assess for potential personnel issues
3.0 Monitor failure reports for potential personnel impacts
4.0 Monitor DRs for potential personnel impacts
5.0 Incorporate personnel inputs as needed
6.0 Coordinate with ESOH specialists to determine that personnel considerations have been addressed for any system modifcations
7.0 Assess safety issues for potential personnel policy impacts



Activities for Each Output:

1.0 Provide personnel inputs as needed
2.0 Prepare personnel assignments and training input for next increment
2.1 Adjust assignments as needed to match next increment schedule
3.0 Make assignment and recruiting adjustments as needed to match modifcations
4.0 Provide personnel inputs as needed
5.0 Assess safety issues for potential personnel policy impacts

References:

- AFPD 36-14
- AFPD 36-21 & AFPD 36-22
- AFI 36-3802
- AFI 36-2623
- AFI 36-2305
- AFI 36-2101 & AFI 36-2110
- T.O. 00-35D-54

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- MIL/CIV PDS, CHRIS, MPES
- JASS, MVTA, TDFA, TSSA
- Task Architect

Operations and Support: Personnel

A
- Review maintenance data for anomalies with personnel implications

B
- Provide personnel input as needed to analyze root issues

C
- Assess personnel impacts associated with system risks and/or hazards
- Identify training implications resulting from risk or hazard mitigation methods

D
- Assess personnel impacts of proposed changes
- Ensure POM inputs include funding for additional assignments and/or training if required
- Adjust assignment schedule to match changes to the manpower baseline

E
- Assess personnel impacts of proposed changes
- Ensure POM inputs include additional assignments funding if required
- Prepare assignment notifcations to match changes to the manpower baseline

F
- Participate in fnal SATAFs, if any, to close out any remaining personnel issues
- Review follow-on Operational Test and Evaluation (OT&E) results for personnel implications

G
- Update TAD and AFSC descriptions as needed
- Review manpower standards applications
- Coordinate on any MACRs with personnel impacts
- Work assignments or other personnel actions as required to support the manpower changes

In-Service Review
- Solicit user feedback against known personnel risk areas and update personnel risks for felded systems as required

Trades
- Participate in trade studies to evaluate options against identifed personnel criteria throughout this phase to ensure personnel concerns are addressed
- Present personnel impacts for trade analyses as required
- Provide personnel inputs to proposed modifcations and upgrades
- Coordinate with other domain POCs as required

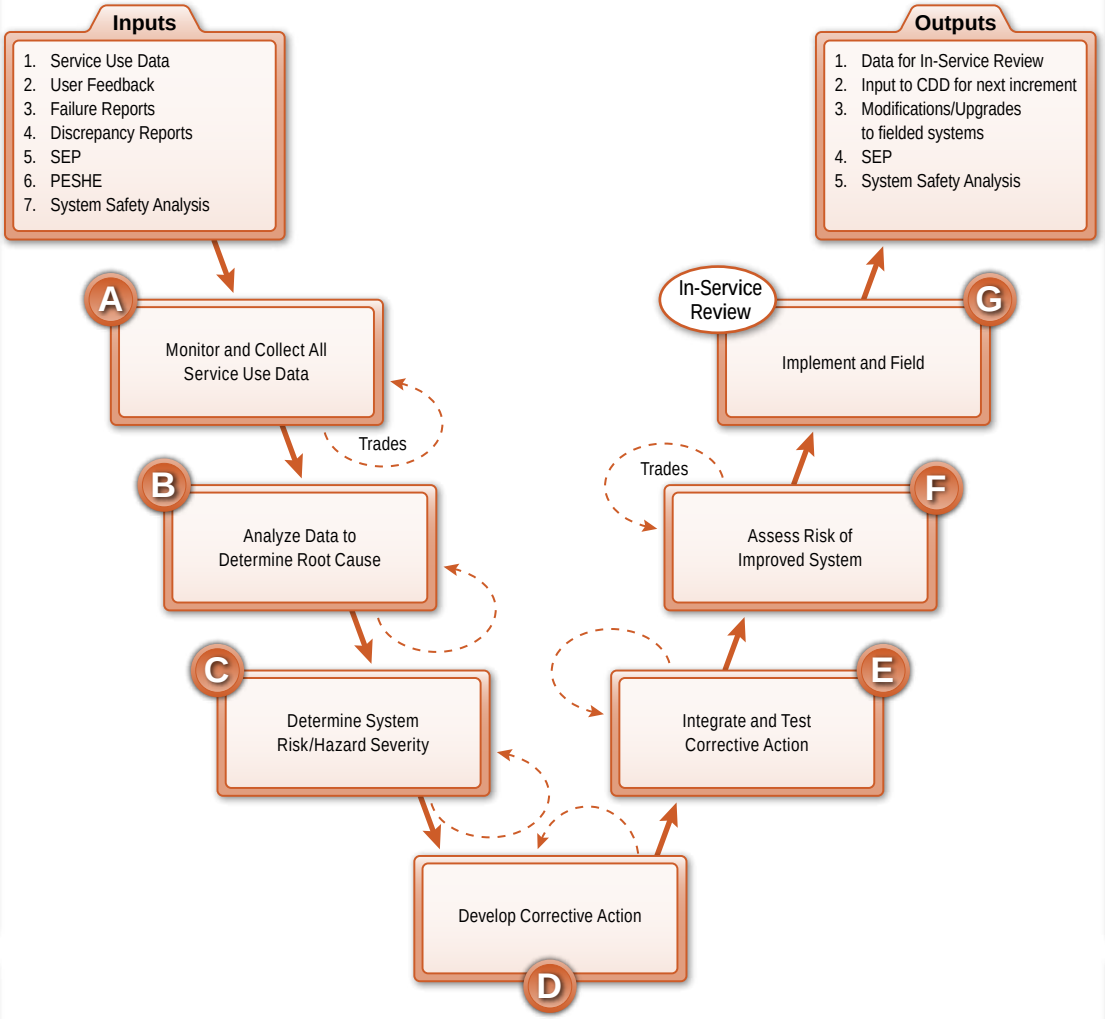
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Training

Activities for Each Input:

1.0 Review and assess training impacts
2.0 Incorporate user feedback in training materials
3.0 Look for trends that may be due to training issues
4.0 Look for trends that may be due to training issues
5.0 Identify training requirements for integration into SE
6.0 Coordinate with ESOH specialists to ensure training considerations have been addressed for any system modifcations
7.0 Review for any issues which may require training adjustments



Activities for Each Output:

1.0 Provide training requirements for training pipeline
2.0 Ensure training documents (*e.g.*, CFETPs) reflect revised training procedures
3.0 Ensure training documents (*e.g.*, CFETPs) reflect revised training procedures
3.1 Ensure training devices accurately reflect configuration changes to the weapon system
4.0 Ensure training requirements are incorporated
5.0 Ensure the analysis includes an assessment on training impacts

References:

- AFI 36-2201 V1 & V2
- AFI 36-2232 & AFI 36-2248
- AFI 36-2251 & AFI 36-2305
- AFH 36- 2235 V3
- AFMAN 36-2234
- AFPD 36-22

Tools:

- HPAT
- ADVISOR
- AIM

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Operations and Support: Training

A
- Monitor system performance reports
- Assess attrition rates for classroom courses
- Monitor upgrade training statistics

B
- Assess training issues associated with root causes
- Review occupational analysis data

C
- Provide risk inputs associated with training issues
- Identify any training risks and costs

D
- Assess training changes needed to implement corrective actions
- Assess the need for new or modifed training devices to respond to system changes from DRs

E
- Review revised training material
- Monitor performance results using new training material
- Collect user input and feedback on revised training material
- Determine how best to acquire new/modifed training devices if needed

F
- Identify any remaining training risks
- Monitor performance using new/modifed training devices if applicable

G
- Field the new training materials
- Field new/modifed training devices if applicable
- Provide data to adjust technical orders if appropriate
- Complete updates of formal training documents

In-Service Review
- Provide a training assessment input
- Solicit user feedback against known training risk areas and update training risks for fielded systems as required

Trades
- Participate in trade studies to evaluate options against training costs throughout this phase to ensure training concerns are addressed
- Present training impacts for trade analyses as required
- Provide training inputs to proposed modifcations and upgrades
- Coordinate with other domain POCs as required

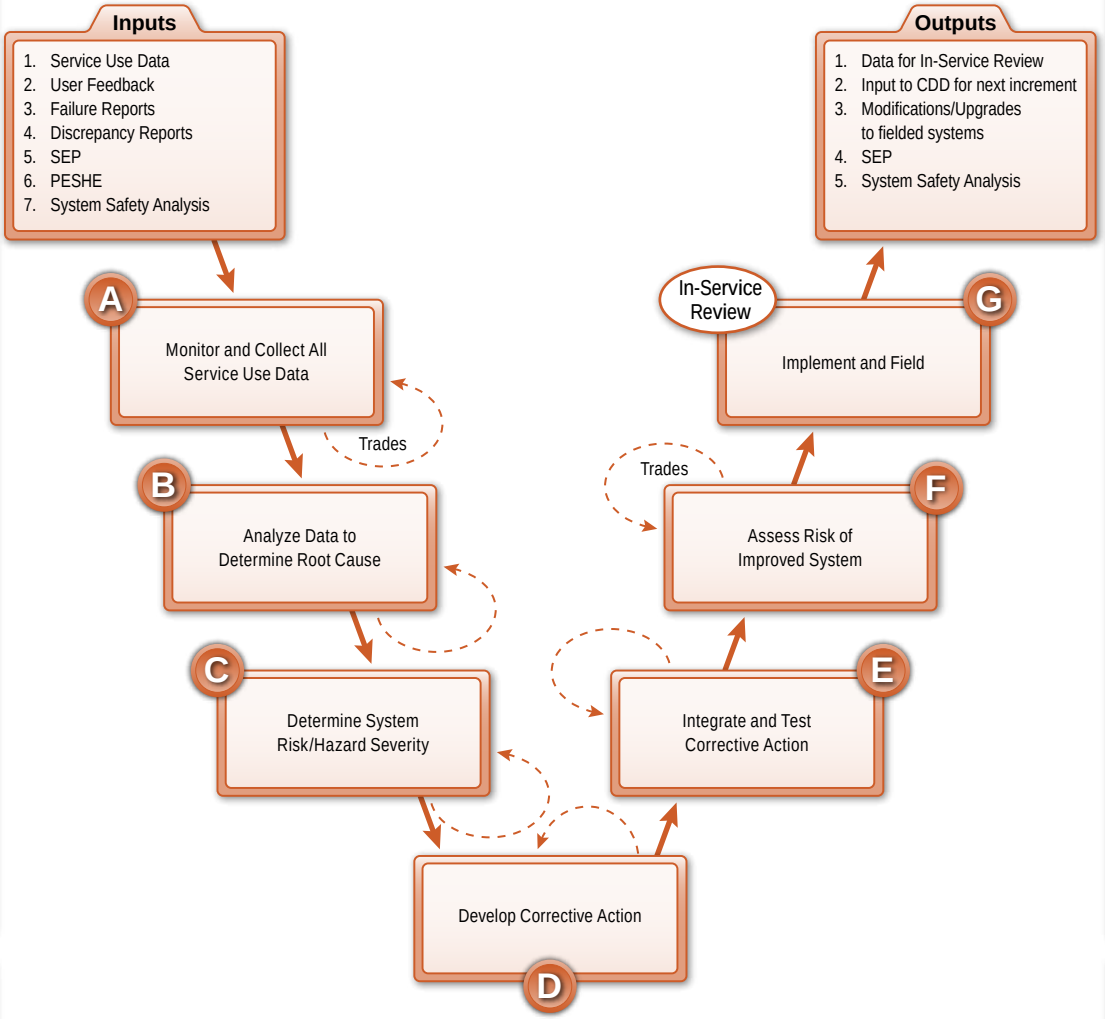
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Human Factors Engineering

Activities for Each Input:

1.0 Monitor data for HFE impacts
1.1 Collect for HFE assessment
2.0 Review for HFE impacts
3.0 Review Follow-on Test and Evaluation (FOT&E) results for HFE implications
4.0 Review DRs for HFE implications
4.1 Assist in mishap investigations as required
5.0 Update strategy for integrating HFE risk management into the SEP
5.1 Identify applicable review and approval boards and applicable HFE processes
6.0 Coordinate with ESOH specialists to ensure HFE considerations have been addressed for any system modifcations
7.0 Provide HFE inputs as required



Activities for Each Output:

1.0 Identify hazards and analyses for fielded systems as applicable
2.0 Update hazard mitigation and mishap reduction requirements as necessary
3.0 Provide updated HFE inputs
4.0 Update strategy for integrating HFE into the SEP
5.0 Assess HFE impacts using applicable checklists/analyses

References:

- DODI 3150.09
- MIL-STD-1472
- AFI 63-101 & AFI 63-1201
- T.O. 00-35D-54

Tools:

- ADVISOR
- IPME
- REHMS-D
- ORCA
- SurveyWIN/EZSurvey
- VACP

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Operations and Support: Human Factors Engineering

A

- Provide system HFE criteria to engineering and logistics staff
- Review data for HFE influenced hazards (*e.g.,* trend analysis)
- Identify opportunities for technology insertion to reduce HFE risks
- Track mishap rates for Class A, B, and C mishaps for the system and subsystems
- Determine whether any technical data change requests have been submitted to resolve HMI or Head-Mounted Display (HMD) issues for the system

B

- Apply appropriate SSA techniques to determine HFE root causal factors
- Evaluate data for HFE implications
- Update deficiency analyses/database, HFE issues database, and HFE Assessment Report as appropriate

C

- Prioritize HFE related hazards for risk mitigation
- Update deficiency analyses/database, HFE issues database, and HFE Assessment Report as appropriate

D

- Apply system safety order of precedence to HFE corrective actions
- Update deficiency analyses/database, HFE issues database, and HFE Assessment Report as appropriate
- Ensure program test reports adequately address HFE as appropriate
- Identify requirements for verification of HFE mitigation control measures

E

- Evaluate test results for risk mitigation control measure effectiveness
- Ensure control measures do not cause latent problems with other domains, systems, human performance, or processes
- Update hazard analyses/database, HFE issues database, and HFE Assessment Report as appropriate

F

- Conduct in-depth system analyses to ensure corrective measures do not contribute to additional deficiencies or degrade human performance
- Recommend deficiency closure to appropriate risk acceptance authorities (updated residual risk)
- Update deficiency analyses/database, HFE issues database, and HFE Assessment Report as appropriate

G

- Track system health, human performance indicators, mishaps, deficiencies, closure actions, effectiveness of mitigation measures, and residual risk to validate enhancement efforts

In-Service Review

- Provide inputs on mishaps and any newly identified hazards with assessment of risks, selected mitigation measures, verification of mitigation controls, and acceptance of residual risks
- Identify open hazardous material or safety related technical data change requests
- Report on status of all high and serious risks
- Solicit user feedback against known HFE risk areas and update HFE risks for fielded systems as required

Trades

- Participate in trade studies to evaluate options against established HFE criteria throughout this phase
- Present HFE impacts for trade analyses as required
- Provide HFE inputs to proposed modifications and upgrades
- Coordinate with other domain POCs as required

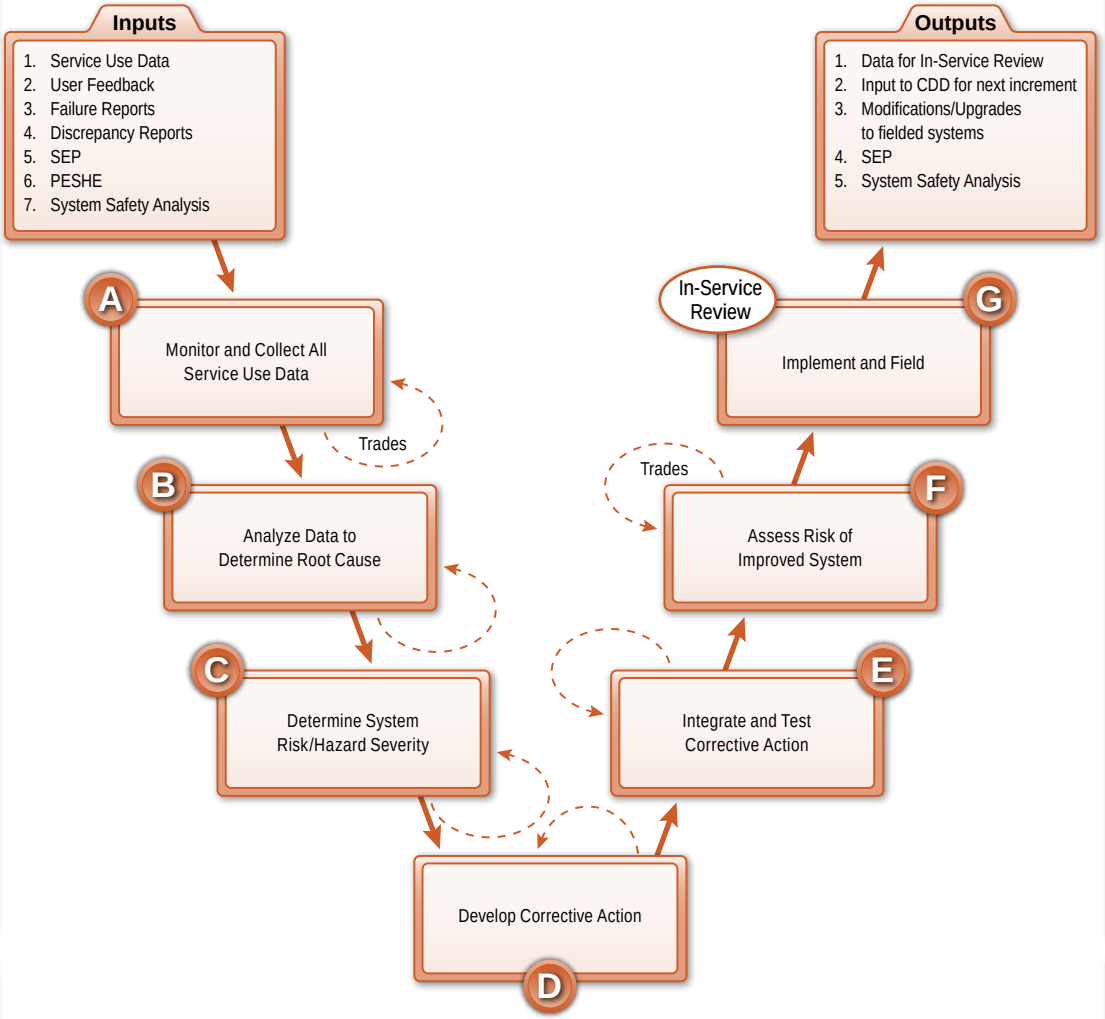
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Survivability

Activities for Each Input:

1.0 Review for Sv hazards
2.0 Review for Sv hazards
3.0 Review FOT&E results for Sv implications
3.1 Review failure and mishaps reports for causal factors or mitigation failures and recommend alternative mitigation measures
3.2 Assist in mishap investigations as required
4.0 Review DRs for Sv relevant causal factors
5.0 Update strategy for integrating Sv risk management into SEP
6.0 Coordinate with ESOH specialists to ensure Sv considerations have been addressed for any system modifcations
6.1 Ensure PESHE includes identifed Sv risks and the strategy for integrating into SEP
6.2 Identify applicable working groups and applicable Sv processes
7.0 Update hazard analyses (as appropriate) in order to maintain current hazard tracking system



Activities for Each Output:

1.0 Identify hazards and analyses for fielded systems and Sv risk acceptance status
2.0 Update hazard mitigation and mishap reduction requirements as necessary
3.0 Present updated residual risk to user
3.1 Present updated Sv inputs for demilitarization/disposal planning
4.0 Update strategy for integrating Sv risk management into the SEP
5.0 Sustain hazard analyses for fielded system and input hazard analyses for next increment or the acquisition of similar systems
5.1 Identify applicable working groups for concurrence

References:

- DODD 5000.01
- DODI 5000.02
- AFPD 63-1/AFPD 20-1
- AFI 63-101 & AFI 63-1201
- AFMAN 63-119
- 10 USC 2366

Tools:

- None specifcally linked to this phase

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Operations and Support: Survivability

A

- Provide system Sv criteria to engineering and logistics staff
- Review data for Sv hazards (*e.g.,* trend analysis)
- Identify opportunities for technology insertion to reduce Sv risk
- Determine whether any technical data change requests have been submitted to resolve Sv issues for the system
- Track open technical data change requests to resolve Sv issues

B

- Apply appropriate system analysis techniques to determine root cause
- Evaluate data for Sv implications
- Update hazard analyses/database as appropriate

C

- Prioritize hazards for risk mitigation
- Update hazard analyses/database as appropriate

D

- Apply system safety order of precedence to corrective actions
- Update hazard analyses/database as appropriate
- Identify requirements for verification of risk mitigation controls

E

- Evaluate test results for risk mitigation effectiveness
- Update hazard analyses/database as appropriate

F

- Update hazard analyses/database as appropriate
- Recommend hazard closure to appropriate risk acceptance authorities (updated residual risk)
- Conduct system analysis to ensure corrective measures do not contribute to additional deficiencies or degrade human performance

G

- Track system Sv, mitigation measure effectiveness, and residual risk

In-Service Review

- Provide inputs on mishaps and any newly identified hazards with assessment of risks, selected mitigation measures, verification of mitigation controls, and acceptance of residual risks
- Identify open hazardous material or safety related technical data change requests
- Report on status of all high and serious risks
- Include System Safety Working Group to support the System Hazard Risk Assessment
- Solicit user feedback against known Sv risk areas and update Sv risks for felded systems as required

Trades

- Participate in trade studies to evaluate options against established Sv criteria throughout this phase to ensure Sv concerns are addressed
- Present Sv impacts for trade analyses as required
- Provide Sv inputs to proposed modifcations and upgrades
- Coordinate with other domain POCs as required

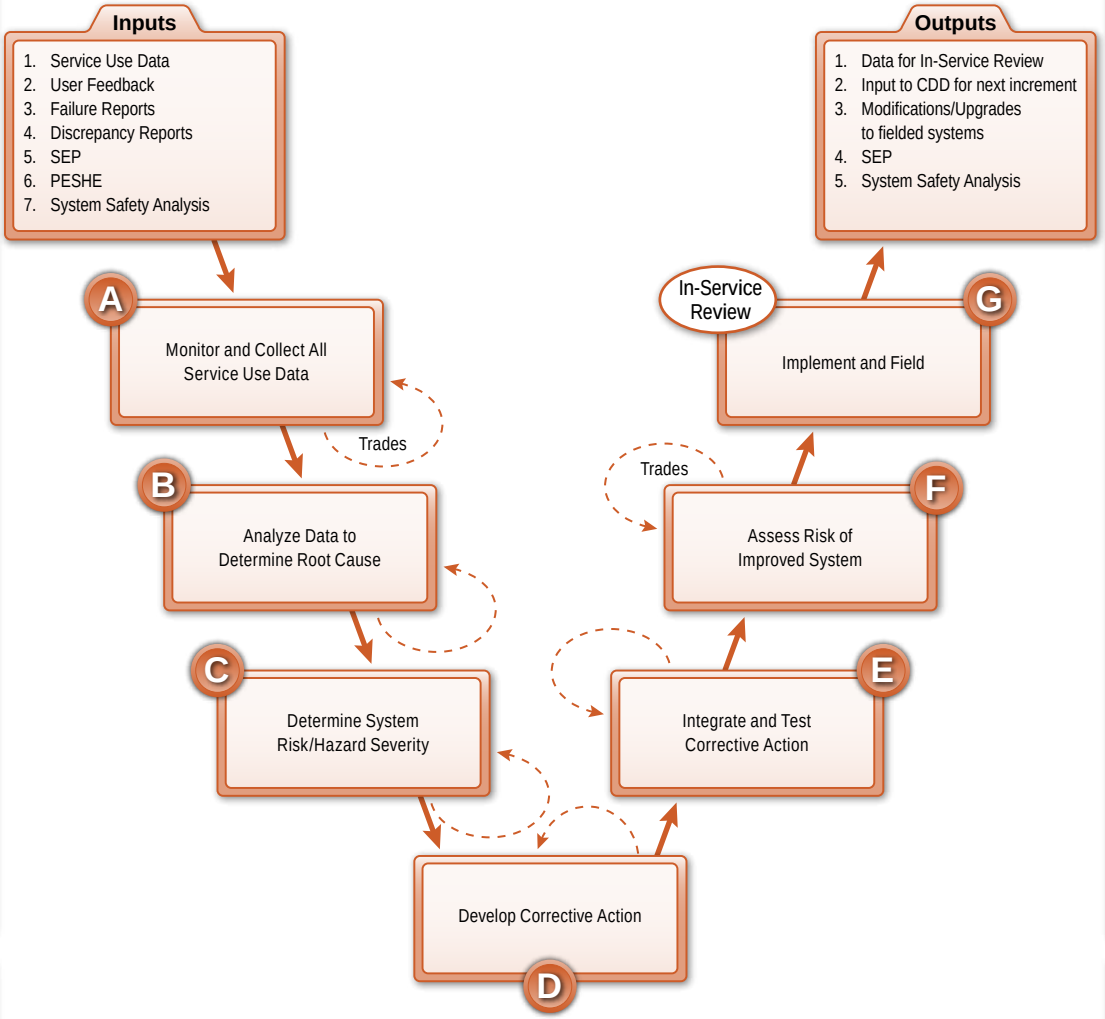
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Environment

Activities for Each Input:

1.0 Review for environment considerations and hazards
2.0 Review for environment considerations and potential hazards
3.0 Review FOT&E results for environment implications
3.1 Review failure/mishap reports for causal factors or mitigation failures
4.0 Review discrepancy reports for environment hazards and implications
5.0 Update strategy for integrating environment risk management into SE
6.0 Ensure PESHE includes identifed environment risks, strategies for integration into SE, system responsibilities in regards to environment, and hazard tracking methods
6.1 Identify safety boards and processes for environment changes
7.0 Update hazard analysis in order to maintain current hazard tracking system



Activities for Each Output:

1.0 Identify hazards and analyses for systems and environment risk acceptance status
2.0 Update hazard mitigation and mishap reduction technology
2.1 Write requirements using environment lessons learned
3.0 Update residual risk
3.1 Provide updated inputs for demilitarization/ disposal planning with environment hazard risks
4.0 Update strategy for integrating environment risk management into SE
5.0 Sustain hazard analyses for felded system
5.1 Input hazard analyses for next increment or similar system acquisitions
5.2 Maintain hazard tracking system with a focus on high and serious risks and hazards without formally accepted risks

References:

- NEPA/EO 12114
- DODI 5000.02
- DODI 4715.4
- MIL-STD-882D
- AFI 63-1201
- AFI 32-7086
- NAS 411: HMMP

Tools:

- HMIRS

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Operations and Support: Environment

A

- Provide environment criteria to engineering and logistics personnel
- Review data for environment hazards and trends
- Identify opportunities for technology insertion to reduce new or current environment risks
- Determine whether any technical data change requests have been submitted to resolve environment issues
- Track open technical data change requests to resolve hazardous material issues

B

- Apply appropriate environment analysis techniques to determine system root causal factors
- Evaluate data for environment hazard implications
- Update hazard analyses and databases

C

- Prioritize hazards for risk mitigation
- Update hazard analyses and databases

D

- Incorporate environment into order of precedence of corrective actions list
- Update hazard analyses and databases
- Identify requirements for verifcation of risk mitigation control measures to infuence corrective actions

E

- Evaluate test results for the effectiveness of mitigation control measures
- Update hazard analyses and databases

F

- Conduct system analyses to ensure corrective measures do not contribute to additional defciencies or degrade human performance
- Recommend hazard closure to appropriate risk acceptance authorities
- Update residual risk documentation
- Update hazard analyses and databases

G

- Track mishaps, defciencies, closure actions, mitigation measure effectiveness, and residual risk to validate enhancement efforts
- Ensure appropriate mitigation controls are used for environment concerns

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In-Service Review

- Provide inputs on mishaps and newly identifed hazards with assessment of risks, mitigation measures, verifcation of mitigation controls, and acceptance of residual risks
- Identify any open HAZMAT and environment related technical data change requests
- Identify status of high and serious risks
- Solicit user feedback against known environment risk areas and update environment risks for felded systems as required

Trades

- Participate in trade-off studies to evaluate environment options against established criteria throughout the Operations & Support Phase to ensure environment concerns are addressed
- Present environment impacts for trade analyses as required
- Provide environment inputs to proposed modifcations and upgrades
- Coordinate with other domain POCs as required

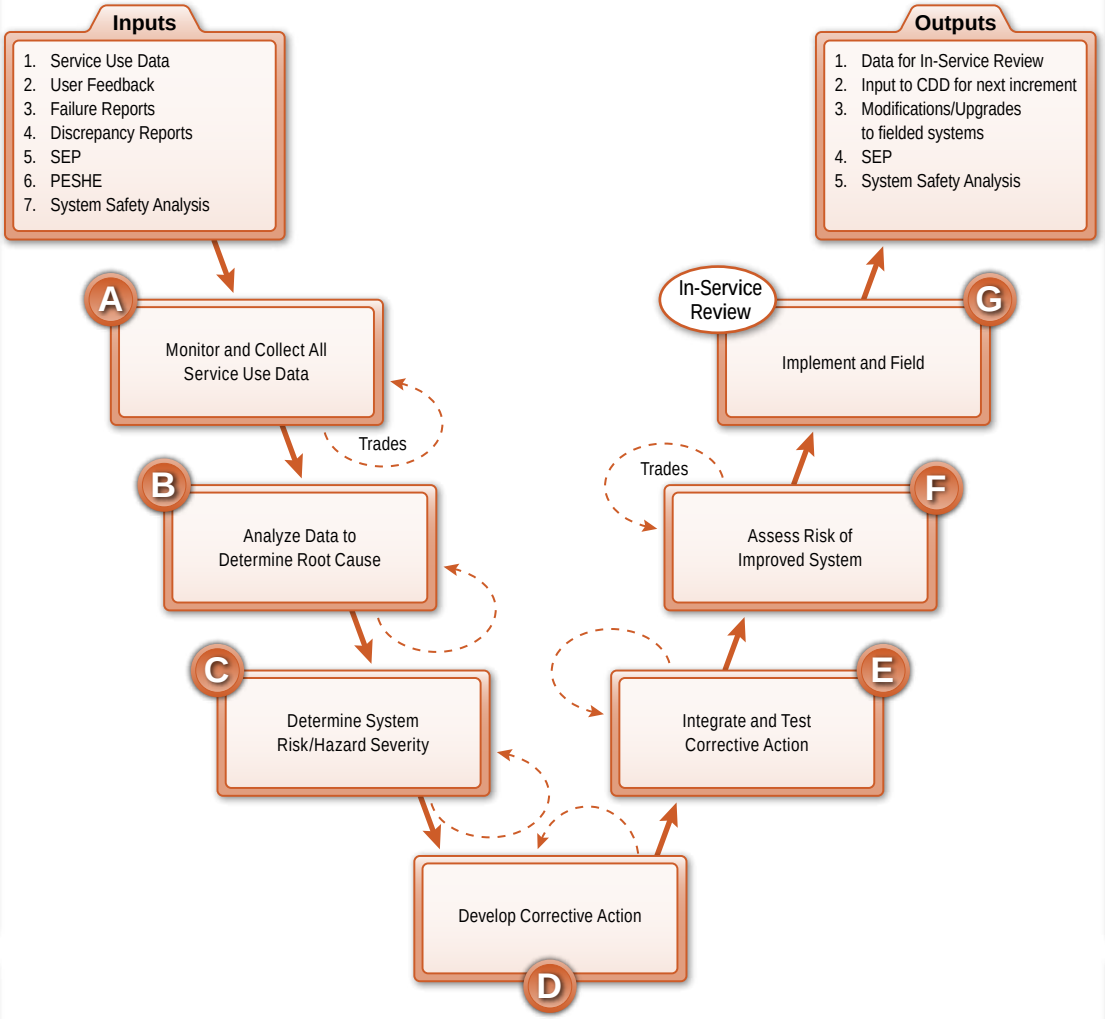
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Safety

Activities for Each Input:

1.0 Review for safety hazard implications
2.0 Review for personnel and system safety considerations and potential hazards
3.0 Review FOT&E results for safety implications
3.1 Review failure/mishap reports for causal factors or mitigation failures
3.2 Provide assistance and lessons learned for mishap investigations
4.0 Review DRs for personnel and system safety implications
5.0 Update strategy for integrating hazard risk management into SE
5.1 Identify applicable safety boards and processes for concurrence/approval
6.0 Ensure PESHE includes identified safety risks, strategy for integration into SE, safety responsibilities, and hazard tracking methods
6.1 Identify safety boards and processes for safety changes
7.0 Update hazard analysis in order to maintain current hazard tracking system



Activities for Each Output:

1.0 Identify safety hazards and analyses for fielded systems and risk acceptance status
2.0 Update hazard mitigation, lessons learned and mishap reduction technology
2.1 Write requirements using safety OH lessons learned
3.0 Update residual risk for users
3.1 Provide updated inputs for demilitarization/ disposal planning with safety risks
4.0 Update strategy for integrating safety risk management into SE
5.0 Sustain hazard analyses for fielded system
5.1 Input hazard analyses for next increment or similar system acquisitions
5.2 Maintain hazard tracking system with a focus on high and serious risks and hazards without formally accepted risks
5.3 Identify applicable safety boards and processes for concurrence/ approval

References:

- MIL-STD-882D
- DAG
- DoD System Safety Handbook
- AFI 63-1201
- AFI 63-101
- DOD 4160.21-M
- AFI 91 Series

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Tools:

- ASAP
- AFSAS
- RiskSafe 7
- HFACS
- HFIX

Operations and Support: Safety

A

- Provide system safety criteria to engineering and logistics personnel
- Review data for safety hazards (*e.g.,* trend analysis)
- Identify opportunities for technology insertion to reduce new or current safety risks
- Track mishap rates for Class A, B, and C mishaps for the system and subsystem elements
- Determine whether any technical data change requests have been submitted to resolve user or system safety issues
- Track open technical data change requests to resolve HAZMAT or safety issues

B

- Apply appropriate SSA techniques to determine system root causal factors
- Evaluate data for safety hazard implications
- Update hazard analyses and databases

C

- Prioritize hazards for risk mitigation
- Update hazard analyses and databases

D

- Identify safety concerns and apply order of precedence to corrective actions list
- Update hazard analyses and databases
- Identify requirements for verification of risk mitigation measures to influence corrections

E

- Evaluate test results for the effectiveness of mitigation control measures
- Update hazard analyses and databases

F

- Conduct system analyses to ensure corrective measures do not contribute to additional deficiencies or degrade human performance
- Identify new or mitigated risks based on system improvements
- Recommend hazard closure to appropriate risk acceptance authorities
- Update residual risk documentation
- Update hazard analyses and databases

G

- Track system health, mishaps, deficiencies, closure actions, mitigation measure effectiveness, and residual risk to validate enhancement efforts
- Ensure appropriate mitigation controls are used for safety concerns

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In-Service Review

- Provide inputs on mishaps and newly identified hazards with assessment of risks, mitigation measures, verification of mitigation controls, and acceptance of residual risks
- Identify any open HAZMAT and safety related technical data change requests
- Evaluate status of high and serious risk
- Solicit user feedback against known safety risk areas and update safety risks for fielded systems as required

Trades

- Participate in trade-off studies to evaluate safety options against established criteria throughout the Operations & Support Phase to ensure safety concerns are addressed
- Present safety impacts for trade analyses as required
- Provide safety inputs to proposed modifications and upgrades
- Coordinate with other domain POCs as required

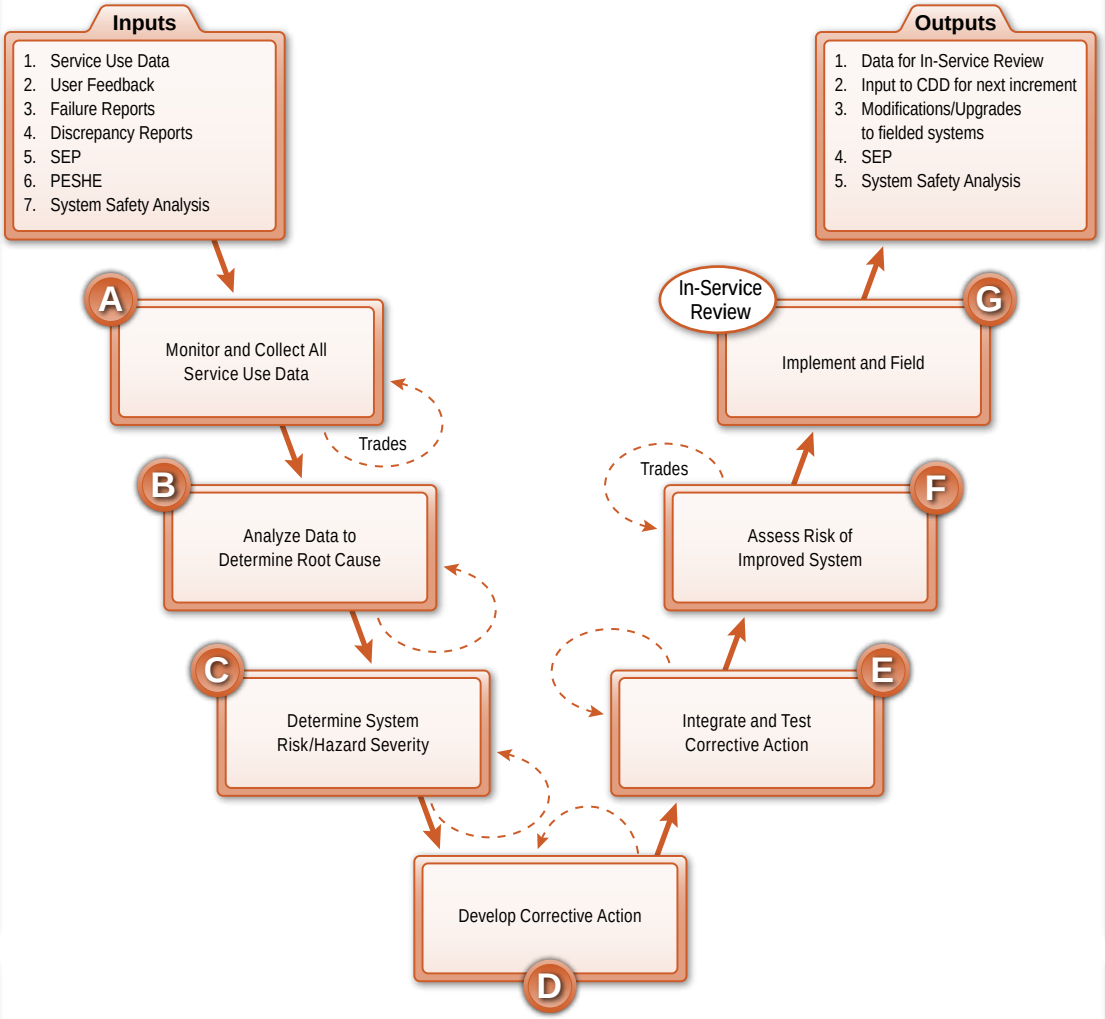
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Occupational Health

Activities for Each Input:

1.0 Review for OH considerations and hazards
2.0 Review for OH considerations and potential hazards
3.0 Review FOT&E results for OH implications
3.1 Review failure/mishap reports for causal factors or mitigation failures
4.0 Review discrepancy reports for OH hazards and implications
5.0 Update strategy for integrating OH risk management into SE
6.0 Ensure PESHE includes identified OH risks, strategy for integration into SE, system responsibilities in regards to OH, and hazard tracking methods
6.1 Identify safety boards and processes for OH changes
6.2 Identify and evaluate emerging technologies to mitigate OH hazards encountered during operations and support of felded systems
7.0 Update hazard analysis in order to maintain current hazard tracking system



Activities for Each Output:

1.0 Identify hazards and analyses for systems and OH risk acceptance status
2.0 Update hazard mitigation and mishap reduction technology
2.1 Write requirements using OH lessons learned
3.0 Update residual risk
3.1 Provide updated inputs for demilitarization/ disposal planning with OH hazard risks
4.0 Update strategy for integrating OH risk management into SE
5.0 Sustain hazard analyses for felded system
5.1 Input hazard analyses for next increment or similar system acquisitions
5.2 Maintain hazard tracking system with a focus on high and serious risks and hazards without formally accepted risks

References:

- MIL-STD-882D
- DoD System Safety Handbook
- DODI 6055.05
- AFI 32-7086 & AFI 63-1201
- AFI 63-101 & AFI 63-1101
- AFPD 90-8
- T.O. 00-35D-54

Tools:

- CARE
- HMIRS
- ESOH Programmatic Risk Assessment Toolset
- BEE

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Operations and Support: Occupational Health

A

- Provide OH criteria to engineering and logistics personnel
- Review data for OH hazards and trends
- Identify opportunities for technology insertion to reduce new or current OH risks
- Determine whether any technical data change requests have been submitted to resolve OH issues
- Track open technical data change requests to resolve HAZMAT issues

B

- Apply appropriate OH analysis techniques to determine system root causal factors
- Evaluate data for OH hazard implications
- Update hazard analyses and databases

C

- Prioritize hazards for risk mitigation
- Update hazard analyses and databases

D

- Apply OH in order of precedence to corrective actions list
- Update hazard analyses and databases
- Identify requirements for verifcation of risk mitigation measures to infuence corrections

E

- Evaluate test results for the effectiveness of mitigation control measures
- Update hazard analyses and databases

F

- Conduct system analyses to ensure corrective measures do not contribute to additional defciencies or degrade human performance
- Recommend hazard closure to appropriate risk acceptance authorities
- Update residual risk documentation
- Update hazard analyses and databases

G

- Track mishaps, defciencies, closure actions, mitigation measure effectiveness, and residual risk to validate enhancement efforts
- Ensure appropriate mitigation controls are used for OH concerns

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In-Service Review

- Provide inputs on mishaps and newly identifed hazards with assessment of risks, mitigation measures, verifcation of mitigation controls, and acceptance of residual risks
- Identify any open HAZMAT and OH-related technical data change requests
- Evaluate status of high and serious risks
- Solicit user feedback against known OH risk areas and update OH risks for felded systems as required

Trades

- Participate in trade-off studies to evaluate OH options against established criteria throughout the Operations and Support Phase
- Present OH impacts for trade analyses as required
- Provide OH inputs to proposed modifcations and upgrades
- Coordinate with other domain POCs as required

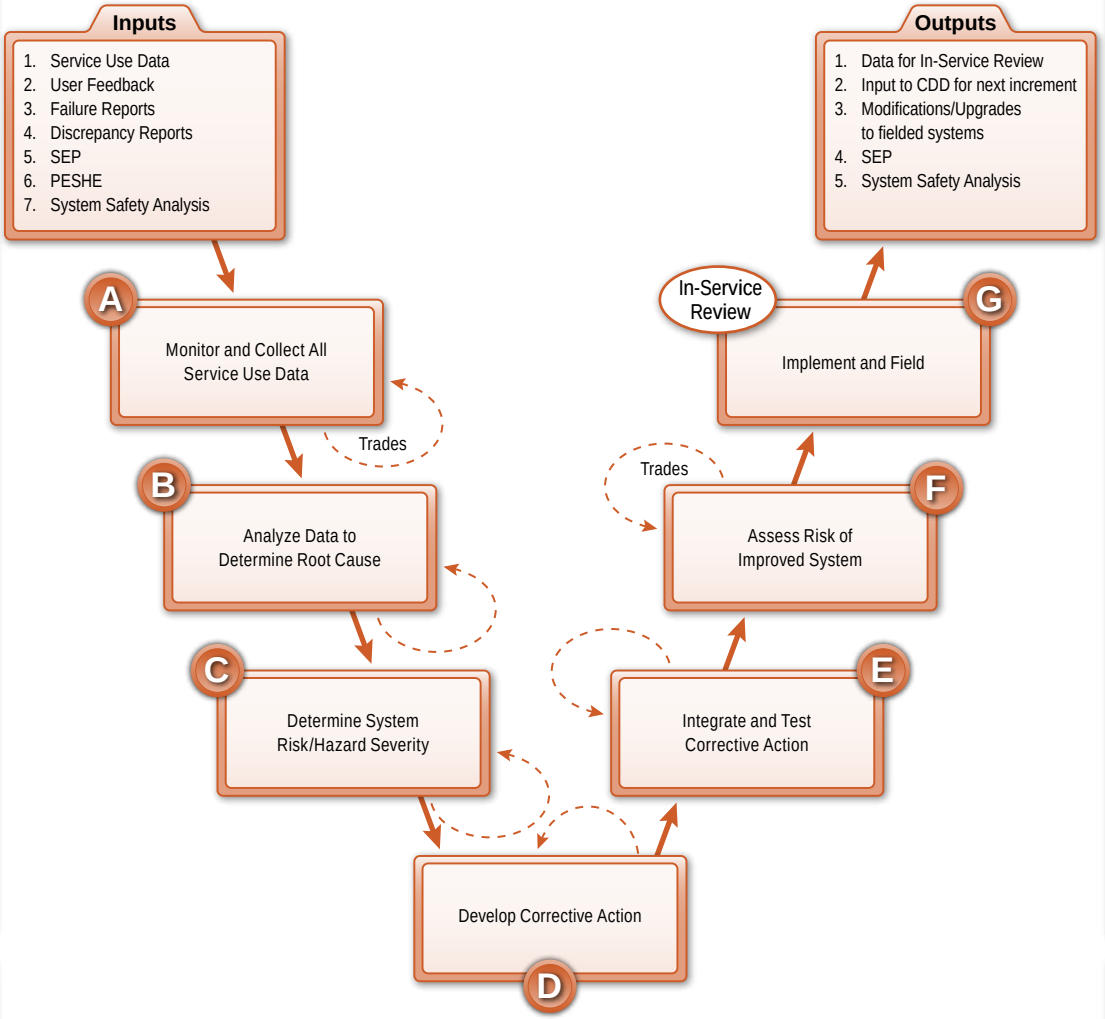
The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

Operations & Support Phase

Habitability

Activities for Each Input:

1.0 Monitor data for habitability impacts in both operations and maintenance
1.1 Evaluate system modifcations for habitability impacts
2.0 Review user feedback for habitability impacts
3.0 Evaluate DRs for habitability impacts
3.1 Review FOT&E results for habitability impacts
4.0 Evaluate DRs for habitability impacts
5.0 Update habitability inputs to HSIP for system modifcations
6.0 Coordinate with ESOH specialists to determine that habitability considerations have been addressed for any system modifcations
7.0 Coordinate with System Safety specialists to update habitability inputs to SSA
7.1 Identify any habitability lessons learned



Activities for Each Output:

1.0 Collect data on habitability impacts for felded systems
2.0 Identify habitability lessons learned for input into CDDs for system modifcations and future systems
3.0 Assess current system performance and user requirements for habitability impacts for system modifcations and upgrades
4.0 Update habitability inputs to HSIP for system modifcations and upgrades
5.0 Coordinate with System Safety specialists to update habitability inputs to SSA

References:

- DODI 5000.02
- DAG
- NASA-STD-3001 Vol II
- AFI 63-101
- T.O. 00-35D-54

Tools:

- Scale mockups
- IMPRINT
- CATIA
- JACK

The numbers in the Activities boxes correspond to the numbers In the Inputs and Outputs boxes.

Operations and Support: Habitability

A
- Solicit user feedback against known habitability risk areas and update habitability risks for fielded systems as required
- Evaluate modifications and upgrades for habitability impacts and risks
- Coordinate with other domain POCs as required

B
- Apply appropriate analysis techniques to determine habitability root causes as required
- Evaluate data for habitability impacts
- Update deficiency databases as required

C
- Update habitability risk analysis for DRs

D
- Develop proposed corrective actions for habitability issues
- Determine whether changes result in materiel or non-materiel solutions
- Participate in trade-off analyses and change management processes as required

E
- Update test strategies for habitability solutions
- Analyze test results and recommend further action as required

F
- Determine habitability risks and impacts as required
- Coordinate with other domains as required

G
- Solicit user feedback on fielded systems

In-Service Review
- Solicit user feedback against known habitability risk areas and update habitability risks for fielded systems as required

Trades
- Present habitability impacts for trade analyses as required
- Provide habitability inputs to proposed modifications and upgrades
- Coordinate with other domain POCs as required

The letters on this page correspond with the letters on the previous page and are associated with the respective SE step boxes.

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Acronyms

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Acronyms

#	**3DSSPP**	Three Dimensional Static Strength Prediction Program
A	**ADA**	Air Defense Artillery
	AF	Air Force
	AFH	Air Force Handbook
	AFHSIO	Air Force Human Systems Integration Office
	AFI	Air Force Instruction
	AFMAN	Air Force Manual
	AFMS	Air Force Manpower Standard
	AFOSH	Air Force Occupational Safety and Health
	AFOTEC	Air Force Operational Test and Evaluation Center
	AFPD	Air Force Policy Directive
	AFSAS	Air Force Safety Automated System
	AFSC	Air Force Specialty Code
	AHAAH	Auditory Hazard Assessment Algorithm for Humans
	AIM	Authoring Instructional Materials
	AoA	Analysis of Alternatives
	APB	Acquisition Program Baseline
	ASAP	Aviation Safety Action Program
	ASR	Alternative System Review
	ATB	Articulated Total Body
	AVOSCET	Autonomous Vehicle Operator Span of Control Evaluation Tool
B	**BCS**	Baseline Comparison System
	BEE	Bioenvironmental Engineer
	BHMS	Boeing McDonnell Douglas Human Modeling System
C	**CARD**	Cost Analysis Requirements Description
	CARE	Computer-Aided Requirements Engineering
	CATIA	Computer-Aided Three-Dimensional Interactive Application
	CCB	Configuration Control Board
	CDD	Capability Development Document
	CDR	Critical Design Review
	CDR-A	Critical Design Review Assessment
	CFETP	Career Field Education and Training Plan
	CHRIS	Comprehensive Human Resources Integrated System
	CI	Configuration Item
	CIV	Civilian
	CJCSI	Chairman of the Joint Chiefs of Staff Instruction
	CJCSM	Chairman of the Joint Chiefs of Staff Manual
	CONOPS	Concept of Operations
	COVART	Computation of Vulnerable Area Tool
	CPD	Capability Production Document
	CSDT	Crew Station Design Tool
D	**DAG**	Defense Acquisition Guidebook
	DCPDS	Defense Civilian Personnel Data System
	DeSAT	Designer's Situation Awareness Toolkit
	DID	Data Item Description
	DI-SAFT	System Safety Data Item Description
	DoD	Department of Defense
	DODD	Department of Defense Directive
	DOD-HDBK	Department of Defense Handbook
	DODI	Department of Defense Instruction

Acronyms

D	**DOEHRS**	Defense Occupational and Environmental Health Readiness System
	DOORS	Dynamic Object-Oriented Requirements System
	DR	Deficiency Report
	DT&E	Developmental Test and Evaluation
E	**ECP**	Engineering Change Proposal
	EMD	Engineering and Manufacturing Development
	EO	Executive Order
	EOA	Early Operational Assessment
	ESAMS	Enhanced Surface-to-Air Missile Simulation
	ESOH	Environment, Safety and Occupational Health
F	**FASTGEN**	Fast Shotline Generator
	FCA	Functional Configuration Audit
	FHA	Fault Hazard Analysis
	FOC	Full Operational Capability
	FOT&E	Follow-on Test and Evaluation
	FRP	Full Rate Production
	FTA	Fault Tree Analysis
H	**HAZMAT**	Hazardous Materials
	HFACS	Human Factors Analysis and Classification System
	HFE	Human Factors Engineering
	HFIX	Human Factors Intervention Matrix
	HF-PFMEA	Human Factors-Process Failure Modes Effects Analysis
	HFRA	Human Factors Risk Analysis
	HMD	Head-Mounted Display
	HMI	Human-Machine Interface
H	**HMIRS**	Hazardous Materials Information Resource System
	HMMP	Hazardous Materials Management Program
	HPAT	Human Performance Analysis Tool
	HSI	Human Systems Integration
	HSIP	Human Systems Integration Plan
I	**IBR**	Integrated Baseline Review
	ICD	Initial Capabilities Document
	IEC	International Electrotechnical Commission
	IMPRINT	Improved Performance Research Integration Tool
	INCOSE	International Council of Systems Engineers
	IOC	Initial Operational Capability
	IPME	Integrated Performance Modeling Environment
	ISO	International Organization for Standardization
	ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
	ISR	In-Service Review
	ITR	Initial Technical Review
J	**JASS**	Job Assessment Software System
K	**KPP**	Key Performance Parameter
	KSA	Knowledge, Skills, and Abilities
L	**LCCE**	Life Cycle Cost Estimate
	LCMP	Life Cycle Management Plan
	LCOM	Logistics Composite Model
	LFT&E	Live Fire Test and Evaluation

Acronyms

L	
LRIP	Low Rate Initial Production
M	
MACR	Manpower Authorization Change Request
MAJCOM	Major Command
MER	Manpower Estimate Report
MIL	Military
MIL/CIV	Military/Civilian
MIL/CIV PDS	Military/Civilian Personnel Data Systems
MIL-HDBK	Military Handbook
MILPDS	Military Personnel Data System
MIL-STD	Military Standard
MPES	Manpower Programming and Execution System
MSA	Materiel Solution Analysis
MVTA	Multimedia Video Task Analysis
N	
N/A	Not Applicable
NAS	National Aerospace Standard
NASA-STD	National Aeronautics and Space Administration Standard
NEPA	National Environmental Policy Act
NEPA/EO	National Environmental Policy Act/Executive Order
NHV	Net Habitable Volume
NIOSH	National Institute for Occupational Safety and Health
O	
O&S	Operations and Support
O&SHA	Operations and Support Hazard Analysis
OH	Occupational Health
OJT	On-The-Job Training
OPSTEMP	Operations Tempo
O	
ORCA	Operational Requirements-Based Casualty Assessment System
OT&E	Operational Test and Evaluation
OTRR	Operational Test Readiness Review
P	
P&D	Production and Deployment
PAL	Parameter Assessment List
PCA	Physical Configuration Audit
PDR	Preliminary Design Review
PDR-A	Preliminary Design Review Assessment
PDS	Personnel Data System
PESHE	Programmatic Environment, Safety and Occupational Health Evaluation
PFMEA	Process Failure Modes and Effects Analysis
PHA	Preliminary Hazard Analysis
PHL	Preliminary Hazard List
POC	Point of Contact
POM	Program Objective Memorandum
PPLAN	Program Plan
PRR	Production Readiness Review
R	
RADGUNS	Radar-Directed Gun System Simulation
REHMS-D	Reliable Human-Machine System Developer
RULA	Rapid Upper Limb Assessment
S	
SA	Situation Awareness
SAGAT	Situation Awareness Global Assessment Technique
SALT	Spatial Analysis and Link Tool
SATAF	Site Activation Task Force
SE	Systems Engineering

Acronyms

S	**SEI**	Special Experience Identifier
	SEP	Systems Engineering Plan
	SFR	System Functional Review
	SHA	System Hazard Analysis
	SME	Subject Matter Expert
	SRCA	Safety Requirements Criteria Analysis
	SRR	System Requirements Review
	SSA	System Safety Analysis
	SSHA	Subsystem Hazard Analysis
	STA	System Threat Assessment
	STR	Student Trained Requirement
	SURVIAC	Survivability/Vulnerability Information Analysis Center
	Sv	Survivability
	SVR	System Verification Review
T	**T&E**	Test and Evaluation
	TAD	Target Audience Description
	TD	Technology Development
	TDFA	Top-Down Functional Analysis
	TDS	Technology Development Strategy
	TEMP	Test and Evaluation Master Plan
	THA	Threat Hazard Assessment
	TO	Technical Order
	TPR	Training Pipeline Requirement
	TRA	Technology Readiness Assessment
	TRR	Test Readiness Review
	TSSA	Trade Space for Systems Analysis
U	**U&TW**	Utilization and Training Workshop
	USC	United States Code
V	**V**	Volume
	VACP	Visual, Auditory, Cognitive, and Psychomotor
	VESARS	Virtual Environment Situation Awareness Rating System

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Glossary

Glossary

Term	Definition
Acquisition Program Baseline	Prescribes the key cost, schedule, and performance constraints in the phase succeeding the milestone for which they were developed. (CJCSI 3170.01G)
Analysis of Alternatives	The evaluation of the performance, operational effectiveness, operational suitability, and estimated costs of alternative systems to meet a mission capability. The analysis assesses the advantages and disadvantages of alternatives being considered to satisfy capabilities, including the sensitivity of each alternative to possible changes in key assumptions or variables. (CJCSI 3170.01G)
Baseline Comparison System	A current operational system, or a composite of current operational subsystems, which most closely represents the design, operational, and support characteristics of the new system under development. (DAG)
Capability Development Document	A document that captures the information necessary to develop a proposed program(s). The CDD outlines an affordable increment of militarily useful, logistically supportable, and technically mature capability, supporting a Milestone B decision review. (CJCSI 3170.01G)
Concept of Operations	A verbal or graphic statement, in broad outline, of a commander's assumptions or intent in regard to an operation or series of operations. It is designed to give an overall picture of the operation. It is also called the Commander's Concept. (CJCSI 3170.01G)
Configuration Item	An aggregation of hardware, firmware, computer software, or any of their discrete portions, which satisfies an end use function and is designated by the government for separate configuration management. (DAG)
Deficiency Report	The generic term used within the AF to record, submit, and transmit deficiency data which may include, but is not limited to a Deficiency Report involving quality, materiel, software, warranty, or informational deficiency data submitted using the SF368, Product Quality Deficiency Report, or equivalent format. (T.O. 00-35D-54)
Engineering Change Proposal	A proposal to the responsible authority recommending that a change to an original item of equipment be considered, and the design or engineering change be incorporated into the article to modify, add or delete, or supersede original parts. (DAG)
Exit Criteria	Program specific accomplishments that must be satisfactorily demonstrated before a program can progress further in the current acquisition phase or transition to the next acquisition phase. (DAG)
First Article Testing	Production testing that is planned, conducted, and monitored by the materiel developer. It includes preproduction and initial production testing conducted to ensure that the contractor can furnish a product that meets the established technical criteria. (DAG)
Human Systems Integration Plan	The HSI Plan is a living document that changes as the system evolves. Typical information includes planning for inventory, force structure, standards of grade, skill and knowledge descriptions, anthropometric data, physical qualifications, aptitude descriptions, training history, and task performance. (DAU PM Magazine, Jul 2002)
Initial Capabilities Document	Documents the need for a materiel approach, or an approach that is a combination of materiel and non-materiel, to satisfy specific capability gap(s). (CJCSI 3170.01G)

Glossary

Term	Definition
Life Cycle Management Plan	Concise document that identifies relevant issues and recommends overall acquisition, program management, and life cycle support strategies. (DAG)
Maintenance Concept	A brief description of maintenance considerations, constraints, and plans for operational support of the system/equipment under development. (DAG)
Operations Tempo	The rate or pace of military actions or the carrying out of a strategic, operational, tactical, service, training, or administrative military mission. (DOD Dictionary of Military Terms)
Operations and Support Hazard Analysis	Evaluates the potential for hazards and the degree of risk resulting from the implementation of operational and support procedures performed by personnel supporting the system. (OSD Acquisition Deskbook)
Preliminary Hazard List	The Preliminary Hazard List is typically a one-time assessment performed early in the acquisition process (*i.e.,* concept and technology development) to identify the initial potential hazards with the system. (OSD Acquisition Deskbook)
Preliminary Hazard Analysis	A Preliminary Hazard Analysis (PHA) is an expansion of the Preliminary Hazard List and documents the safety critical areas and initial assessment of the identified hazards in terms of probability and severity. The PHA identifies the required corrective actions to eliminate or control the hazard risks. (OSD Acquisition Deskbook)
Program Objective Memorandum	An annual memorandum in prescribed format submitted to the Secretary of Defense (SECDEF) by the DoD Component heads, which recommends the total resource requirements and programs within the parameters of SECDEF's fiscal guidance. (DAG)
Risk management	The overarching process that encompasses identification, analysis, mitigation planning, mitigation plan implementation, and tracking of future root causes and their consequences. (DAG)
System Hazard Analysis	A System Hazard Analysis is performed to identify hazards associated with the subsystem interfaces and system functional faults, and to assess the degree of risk associated with the total system design, including software. (OSD Acquisition Deskbook)
System Engineering Plan	A description of the program's overall technical approach including processes, resources, metrics, applicable performance incentives, and the timing, conduct, and success criteria of technical reviews. (DAG)
System Verification Plan	A plan for validating all interface functional and performance specifications. (DAG)
Systems Engineering Technical Reviews	Technical reviews provide a structured and organized approach to reviewing project products to determine if they are fit for their intended use. They provide status and feedback on the products under review and the on-going activities of a project. A technical review is the primary method for communicating progress, coordinating tasks, monitoring risk, and transferring products and knowledge between the team members of a project. (DAG)

Glossary

Term	Definition
Technology Readiness Levels	One level on a scale of one to nine, *e.g.,* "TRL 3," signifying technology readiness pioneered by the National Aeronautics and Space Administration, adapted by the Air Force Research Laboratory, and adopted by the Department of Defense as a method of estimating technology maturity during the acquisition process. The lower the level of the technology at the time it is included in a product development program, the higher the risk that it will cause problems in subsequent product development. (DAG)
Test and Evaluation Master Plan	Documents the overall structure and objectives of the Test and Evaluation (T&E) program. It provides a framework within which to generate detailed T&E plans and it documents schedule and resource implications associated with the T&E program. (DAG)
Trade Space	The "trade space" can be defned as the set of program and system parameters, attributes, and characteristics required to satisfy performance standards. Decision makers defne and refne the developing system by making tradeoffs with regard to cost, schedule, risk, and performance; all of which fall within the systems trade space. (DAU Acquisition Review Quarterly, Winter 2002)

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Tools

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Tools

Name	Description	Applicability	
		Domain	Phase
3D System Safety Engineering Analysis	This analytic technique uses a human system analog model construct to integrate the human component into an equation describing System Safety by measuring exposure, severity, and likelihood in U.S. Government specifcations and standards. http://www.dtic.mil/dticasd/ddsm/tools.html	• Safety	• TD-Outputs; EMD-Inputs/Outputs; P&D
3DSSPP (3D Static Strength Prediction Program)	This software predicts static strength requirements for tasks such as lifts, presses, pushes and pulls. The program provides an approximate job simulation that includes posture data, force parameters, and anthropometry. Output includes the percentage of men and women who have the strength to perform the described job, spinal compression forces, and data comparisons to NIOSH guidelines. An interface to the ErgoMaster in 2D mode is available. See the description of Ergo Master in this tools appendix. http://www.engin.umich.edu/dept/ioe/3DSSPP	• Human Factors Engineering	• TD-Outputs
ACT-R	ACT-R is a cognitive architecture used to understand how people organize knowledge and produce intelligent behavior. Research is continuing to expand ACT-R capabilities to understand the full range of human cognitive tasks. http://act-r.psy.cmu.edu	• Human Factors Engineering	• TD-Outputs; P&D
ADVISOR	ADVISOR Enterprise is an internet based decision support tool to help organizations manage training budgets and resources from a central location as well as identify ways to run training programs more effectively and economically. ADVISOR is made up of 4 modules that can be used separately or in combination. http://www.bnhadvisor.com/index.htm	• Training	• All Phases
		• Human Factors Engineering	• O&S
AFMSs (Air Force Manpower Standards)	Air Force Manpower Standards document functional process descriptions and mathematical equations for estimating manpower requirements. They are developed by the Air Force Manpower Agency for functional career felds and are published on the Air Force Portal.	• Manpower	• TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D; O&S
AFSAS (Air Force Safety Automated System)	The AFSAS system provides a web-based mishap reporting and data management tool that allows quick, accurate tracking of mishaps and trends. http://www.cti-crm.com/afrcsafety/programs/index.php?area=afsas	• Safety	• EMD-Inputs/Outputs; P&D; O&S
AHAAH (Auditory Hazard Assessment Algorithm for Humans)	A mathematical model of the human ear that predicts the hazard from any free-feld pressure, and provides a visual display of the damage process as it is occurring in the inner ear. The model provides a numerical rating of hazard and identifes specifc parts of the waveform that are causing the hazard. http://www.arl.army.mil/ARL-Directorates/HRED/AHAAH	• Occupational Health	• TD-Inputs/Outputs; EMD-Inputs

Tools

Name	Description	Applicability	
		Domain	Phase
AIM (Authoring Instructional Materials)	A government-managed system used by the Navy and other agencies to develop, update, manage, and integrate training content. AIM automates the systems approach to training. It ensures uniform formatting and compliance of all required output products, in any form, from paper to web. AIM provides highly effcient design, development, surveillance, maintenance, and production of training and educational materials. http://nawctsd.navair.navy.mil/Programs/TrainerDescriptions/UnderseaPrograms/AIM.cfm	• Training	• All Phases
Anthropometry Measurements	Anthropometry refers to the measurement of individuals for the purposes of understanding human physical variation. Anthropometry plays an important role in industrial design, clothing design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products. http://msis.jsc.nasa.gov/sections/section03.htm	• Habitability	• TD-Outputs; EMD-Inputs/Outputs; P&D
ASAP (Aviation Safety Action Program)	The ASAP provides a vehicle to report safety concerns. The focus of ASAP is on fxing problems, rather than on FAA punitive enforcement or company disciplinary action. An ASAP requires that corrective action be accomplished for all safety issues disclosed under the program. http://www.faa.gov/about/initiatives/asap/	• Safety	• P&D; O&S
ATB Model (Articulated Total Body Model)	The ATB model is a simulation program developed for the prediction of human body dynamics during aircraft ejection, aircraft crashes, automobile accidents, and other hazardous events. It is used in the Air Force to determine the safety of restraint systems, seats, escape systems, controls and displays, and other equipment in the aircraft cockpit during development. http://www.dtic.mil/dticasd/ddsm/tools.html	• Human Systems Integration	• EMD-Inputs/Outputs
		• Safety	• MSA; TD-Inputs
AVOSCET (Autonomous Vehicle Operator Span of Control Evaluation Tool)	AVOSCET is a tradeoff analysis tool specifcally designed to help analysts determine how many autonomous systems an operator or a crew can control under a variety of conditions. AVOSCET allows an analyst to defne specifc parameter values for a particular mission involving autonomous systems. Parameters can be entered for vehicle, operator, and mission characteristics. Once a user has defned an analysis, AVOSCET launches its task network simulation to simulate the mission of the autonomous systems and their operators. Results are then fed back to the AVOSCET interface where the user can view and evaluate the performance metrics of the autonomous systems and their operators through AVOSCET's report utility. http://www.maad.com/index.pl/avoscet	• Human Factors Engineering	• MSA; TD-Outputs; EMD-Inputs

Tools

Name	Description	Applicability	
		Domain	Phase
BEE (Bioenvironmental Engineer)	Bioenvironmental engineers ensure safe and healthy workplaces for Air Force people. Acquisitions professionals can use their professional advice to make important decisions regarding weapons systems and associated processes; facilities; and chemical, biological and radiological issues.	• Occupational Health	• All Phases
BHMS (Boeing McDonnell Douglas Human Modeling System)	The BHMS is a software tool designed specifcally for engineering applications. BHMS is a menu-driven, interactive computer program used to defne human factors design requirements and aid in design evaluation. BHMS provides a set of human modeling and human task simulation tools that allow the user to establish design-to requirements, test reach accommodation, study human motion, and perform various ft and function evaluations of their present design. http://www.boeing.com/assocproducts/hms	• Human Factors Engineering	• TD-Outputs
BRAWLER	BRAWLER simulates air-to-air combat between multiple fights of aircraft in both the visual and beyond-visual range arenas. This simulation of fight-versus-fight air combat is considered to render realistic behaviors by Air Force pilots. BRAWLER incorporates value-driven and information-oriented principles in its structure to provide a Monte Carlo, event-driven simulation of air combat between multiple fights of aircraft with real-world stochastic features. http://www.bahdayton.com/surviac/brawler.htm	• Survivability	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs
CARE (Computer-Aided Requirements Engineering)	CARE is a requirements development/engineering tool for generating, structuring, and managing requirements on complex software systems developed by the SOPHIST Group. http://213.95.18.229/sopgroupeng.nsf/(ynDK_framesets)/ExternLinkHandler?Open&url1=JNOK-5PAJ4M	• Occupational Health	• P&D; O&S
CATIA (Computer Aided Three-Dimensional Interactive Application)	CATIA (V6) is a collective, integrated multi-disciplinary model for product development. CATIA's RFLP approach includes aggregating Requirements, Functional, Logical, and Physical product defnitions. Meta-CAD modeling delivers a collaborative, liberated design environment. In addition to 3D system design, CATIA also integrates a 3D human modeling component to simulate human-system interaction in a virtual environment. http://www.3ds.com/products/catia/catia-discovery	• Human Systems Integration	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs
		• Human Factors Engineering	• TD-Inputs/Outputs; EMD-Inputs/Outputs
		• Habitability	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; O&S

Tools

Name	Description	Applicability	
		Domain	Phase
CHRIS (Comprehensive Human Resources Integrated System)	CHRIS is a Human Resources Management tool that integrates data from the Defense Civilian Personnel Data System, the AF Military Personnel Data System, the AF Manpower Programming and Execution System, and the AF Materiel Command Employee Training Management System. This tool provides reporting capability on the total force military (active duty, guard and reserve) and civilian workforce from a single web based user interface (Business Objects Xi). It provides the ability to identify mismatches between authorizations and assignments; identify retirement eligibility dates and associated retirement plan/status for individuals; and forecast losses. With a CAC card: https://chris.wpafb.af.mil or in the AF Portal: https://www.my.af.mil/infoviewapp/loginform.asp	• Manpower	• All Phases
		• Personnel	• All Phases
ComputerMan (Army)	The ComputerMan Model is a software tool for studying the effects of penetrating injuries to personnel. This model is designed to simulate the wounding process and to predict injury outcomes in terms of performance degradation and survivability. ComputerMan is used in weapons assessment studies and vulnerability assessments. http://www.dtic.mil/dticasd/ddsm/tools.html	• Survivability	• EMD-Inputs/Outputs
Cost Avoidance Methodology	Materiel health system hazard costs are related to the existing health risk indices. This information is used to provide a total cost related to hazards inherent in materiel systems. If abatement costs are provided, a cost effectiveness index can be calculated. This should promote an increase in the reduction or elimination of health hazards. http://www.dtic.mil/dticasd/ddsm/srch/DDSM0158.pdf	• Safety	• TD-Outputs
		• Occupational Health	• TD-Inputs/Outputs; EMD-Inputs/Outputs
COVART (Computation of Vulnerable Area Tool)	The COVART model predicts the ballistic vulnerability of vehicles (fxed-wing, rotary-wing, and ground targets), given ballistic penetrator impact. Each penetrator is evaluated along each shotline (line-of-sight path through the target). Whenever a critical component is struck by the penetrator, the probability that the component is defeated is computed using user defned conditional probability-of-component dysfunction given a hit (Pcd/h) data. http://www.bahdayton.com/surviac/covart.htm	• Survivability	• TD-Inputs/Outputs; EMD-Inputs/Outputs
CSDT (Crew Station Design Tool)	CSDT allows designers to visualize and optimize the types and position of controls and displays in a workstation. It automatically determines the optimum arrangement of controls and displays through the use of three different software tools: 1) Micro Saint Sharp – a task network modeling tool; 2) Open Inventor – a three-dimensional graphics environment; and 3) Jack – a human fgure (anthropometric) modeling tool. Detailed descriptions of Micro Saint Sharp and Jack are also in this appendix. http://www.maad.com/index.pl/crew_station_design_tool	• Human Factors Engineering	• TD-Inputs/Outputs; EMD-Inputs/Outputs

Tools

Name	Description	Applicability	
		Domain	Phase
Delmia-Human	Delmia-Human is a human factors project lifecycle management tool. It contains digital human modeling technology to assist a designer in determining the performance of people in the workplace or to assess a product before it exists and throughout its entire lifecycle. http://www.3ds.com/products/delmia/solutions/human	• Human Factors Engineering	• TD-Inputs; EMD-Inputs
DeSAT (Designer's Situation Awareness Toolkit)	DeSAT aids designers in creating systems that support situation awareness (SA). DeSAT provides support to the designer for each of the three phases of the SA-oriented design process: analyzing SA requirements, applying SA-oriented design principles, and measuring SA during design evaluation. http://www.satechnologies.com/products	• Human Factors Engineering	• EMD-Inputs; P&D
Discrete Event Simulation	This is a category of tools which represent the operation of a system as a chronological sequence of events. Each event occurs at an instant in time and marks a change of state in the system. For example, if an elevator is simulated, an event could be "level 6 button pressed", with the resulting system state of "lift moving" and eventually (unless one chooses to simulate the failure of the lift) "lift at level 6". A variety of different software tools are available and the following web site provides some tool descriptions and information. http://www.discrete-event-simulation.com Also see Micro Saint Sharp in this tools appendix.	• Manpower	• EMD-Outputs; P&D; O&S
DOEHRS (Defense Occupational and Environmental Health Readiness System)	DOEHRS is the Theater Medical Information Program capability for exposure data collection, analysis, and storage with respect to: industrial hygiene, environmental health, preventive medicine and radiation protection. DOEHRS contains records of workplace exposures to identify health risks, protective measures the employee can take, and information for health care providers to make better medical diagnosis and treatment decisions. https://doehrs-ih.csd.disa.mil/Doehrs	• Occupational Health	• TD-Inputs/Outputs; EMD-Inputs/Outputs
DOORS (Dynamic Object-Oriented Requirements System)	DOORS is an information management and traceability tool. Requirements are handled as discrete objects and each requirement can be tagged with an unlimited number of attributes allowing easy selection of subsets of requirements. It includes an on-line change proposal and review system that lets users submit proposed changes to requirements, including a justification. DOORS offers unlimited links between all objects in a project for full multi-level traceability. Impact and traceability reports as well as reports identifying missing links are all available across all levels or phases of a project life cycle. Verification matrices can be produced directly or output in any of the supported formats including rich text format for MS-Word. http://www.telelogic.com/corp/products/doors	• Occupational Health	• EMD-Outputs; P&D

Tools

Name	Description	Applicability	
		Domain	Phase
Enovia V5 DMU Simulations	V5 DMU for Human Simulation can create, manipulate and simulate accurate digital manikin interactions in context with a virtual product. It takes into account target population specifcity and supports a unique and accurate manikin model through the entire product lifecycle. http://www.3ds.com/products/enovia/mid-market/v5-dmu-solutions/overview	• Human Factors Engineering	• TD-Outputs
Environmental Hierarchy	The environmental hierarchy technique provides a rational structure to evaluate environmental/system tradeoffs. Users first decompose their decision problem into a hierarchy of more easily comprehended sub-problems and compare them two at a time. These evaluations are converted to numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy allowing a rational and consistent comparison.	• Environment	• MSA
ErgoImager	ErgoImager is a Windows-based ergonomic design and job-analysis program. ErgoImager allows users to import digital images and superimpose a 3D mannequin using various translation techniques and technology from our ManneQuin technology. ErgoImager provides reports with the original image, mannequin in the posture matching the image and selected results from the 3DSSPP. ErgoImager is used in product design and ergonomic job evaluations. A description of 3DSSPP is also available in this appendix. http://nexgenergo.com/ergonomics/ergoimager.html	• Human Factors Engineering	• EMD-Outputs; P&D
ErgoMaster	ErgoMaster is a suite of software modules that enables users to incorporate video and photographic images from a variety of sources. The tools include biomechanics, NIOSH lifting equations, and rapid upper limb assessment (RULA). An interface to the University of Michigan's 3DSSPP in 2D mode is available thru the Biomechanics Analyst module. ErgoMaster is used for ergonomic job evaluations. A description of 3DSSPP is also available in this appendix. http://www.nexgenergo.com/ergonomics/ergomast.html	• Human Factors Engineering	• EMD-Outputs; P&D
ErgoWeb JET	ErgoWeb's JET software is made up of a suite of 13 ergonomic job evaluation methods used to identify and control ergonomic concerns. It is a comprehensive suite of ergonomic workplace evaluation and control tools. It uses a web-based interface that allows users to run the software over a variety of operating systems. http://www.ergobuyer.com/index.cfm/product/84_5	• Human Factors Engineering	• EMD-Outputs; P&D

Tools

Name	Description	Applicability	
		Domain	Phase
ESOH Programmatic Risk Assessment Toolset	This tool qualitatively and quantitatively assesses ESOH risks associated with cost, schedule, and performance decisions when designing and developing a new system. It was developed to help Program Managers, ESOH professionals, engineers, and others to 1) manage ESOH actions during a program's life, 2) compile the PESHE, 3) gauge the effectiveness of the ESOH program management structure, and 4) facilitate the integration of ESOH considerations in the Acquisition Strategy and SE processes.	• Environment	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D
		• Safety	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D
		• Occupational Health	• TD-Outputs; EMD-Inputs/Outputs; P&D; O&S
ESAMS (Enhanced Surface-to-Air Missile Simulation)	ESAMS is a digital computer program used to model the interaction between a single airborne target and a surface-to-air missile air defense system. The model provides comprehensive representation of the Soviet land-based and naval missile systems and models aircraft from their signature and vulnerability data. http://www.bahdayton.com/surviac/esams.htm	• Survivability	• TD-Inputs/Outputs; EMD-Inputs/Outputs
FASTGEN (Fast Shotline Generator)	FASTGEN traces the path of a projectile's shotline through a target. This model projects a number of parallel rays through the target with a specified direction and describes the encounters along each ray. The result is a sequential list of components, subsets of the target, which are encountered by a shotline. http://www.bahdayton.com/surviac/fastgen.htm	• Survivability	• TD-Inputs/Outputs; EMD-Inputs/Outputs
FHA (Fault Hazard Analysis)	This is an analysis technique which documents the ways in which a system component may fail and the effect of the failure on the performance of that element, system, or personnel.	• Environment	• TD-Inputs/Outputs; EMD-Inputs/Outputs
FTA (Fault Tree Analysis)	Failure analysis in which an undesired state of a system is analyzed using Boolean logic to combine a series of lower-level events.	• Environment	• TD-Inputs/Outputs; EMD-Inputs

Tools

Name	Description	Applicability	
		Domain	Phase
HFACS (Human Factors Analysis and Classifcation System)	HFACS identifes the human causes of an accident and provides a tool to not only assist in the investigation process, but to target training and prevention efforts. HFACS looks at four levels of human error including: unsafe acts, preconditions of unsafe acts, unsafe supervision, and organizational infuences. http://safetycenter.navy.mil/hfacs/Default.htm	• Safety	• All Phases
HFIX (Human Factors Intervention Matrix)	The Human Factors Intervention matriX (HFIX®) is an innovative tool for mapping intervention strategies onto the specifc forms of human error identifed in the HFACS model. HFIX allows users to systematically generate comprehensive intervention strategies that directly target the underlying systemic causes of errors. http://hfacs.com/index.html	• Safety	• All Phases
HF-PFMEA (Human Factors–Process Failure Modes & Effects Analysis)	This software tool was developed to systematically analyze each task in a process to identify potential human errors, their respective worst-case effects on a system, and the factors that increase the likelihood of the human error. The HF-PFMEA software tool helps the user identify: potential individual or team human errors, factors contributing to or affecting the potential for human error occurrence, barriers to prevent errors or inhibit the effect of errors, risks associated with human errors, and recommendations to reduce errors or mitigate their effects. http://rtreport.ksc.nasa.gov/techreports/2003report/500/509.html	• Human Factors Engineering	• EMD-Inputs
HFRA (Human Factors Risk Analysis)	Relex's HFRA is based on a Process Failure Modes and Effects Analysis (PFMEA) approach. PFMEAs are primarily used to assess the safety and reliability of a process by analyzing potential failure modes of the process and can be used to assess the human safety and human reliability by analyzing human processes. Relex's HFRA includes a comprehensive database of errors, contributing factors, barriers, and controls. Relex HFRA offers a unique Data Entry Wizard to walk the analyst through each step of the process. The Data Entry Wizard assists the user in developing a well-organized and comprehensive analysis. http://www.relexsoftware.com/products/humanfactors.asp	• Human Factors Engineering	• EMD-Outputs

Tools

Name	Description	Applicability	
		Domain	Phase
HMIRS (Hazardous Materials Information Resource System)	HMIRS is the central repository for Material Safety Data Sheets for the United States Government military services and civil agencies. It also contains value-added information input by the service/ agency focal points. This value-added data includes HAZCOM warning labels and transportation information. http://www.dlis.dla.mil/HMIRS/	• Environment	• EMD-Inputs/Outputs; P&D; O&S
		• Safety	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D
		• Occupational Health	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D; O&S
HPAT (Human Performance Analysis Tool)	HPAT is an end-to-end software suite to plan for and execute human performance studies and analyze the associated human performance data in a variety of execution environments. The HPAT Suite consists of a Planner, Observer, and an Analyzer. The Planner tool provides several features for creating data collection plans to be used in the Observer tool. The Observer tool takes data collection plans created in the Planner tool and provides a tailored system for taking manual observations of system performance. The Analyzer provides a framework for examining the results collected in the Observer tool. http://www.sonalysts.com/training/case_studies/index.html	• Training	• All Phases
HSI Requirements Guide	The HSI Requirements Guide provides templated HSI requirements. This guide's purpose is three-fold: First, to assist requirements writers in documenting solid, unambiguous human requirements in AF and DoD level acquisition documents. Second, to assist HSI domain requirements writers in understanding where they ft into Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. Finally, to serve as learning tool/quick reference source for HSI domain representatives who are called upon to assist with writing requirements documents.	• All Domains	• MSA

Tools

Name	Description	Applicability	
		Domain	Phase
IMPRINT (Improved Performance Research Integration Tool)	An HSI tool developed by the U.S. Army Research Laboratory, Human Research & Engineering Directorate. It is a dynamic, stochastic discrete event network modeling tool designed to assess the interaction of soldier and system performance throughout the system life cycle--from concept and design through feld testing and system upgrades. http://www.arl.army.mil/ARL-Directorates/HRED/imb/imprint/Imprint7.htm	• Human Systems Integration	• All Phases
		• Human Factors Engineering	• MSA; TD-Inputs
		• Habitability	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; O&S
Index of Habitability	A quantitative method for assessing environmental effects on individual crew members during spaceflight. http://human-factors.arc.nasa.gov/ihh/psychophysio/current_projects/spacehumanfactors.html	• Habitability	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D
IPME (Integrated Performance Modeling Environment)	IPME is an integrated environment of models intended to help the human factors practitioner analyze human-system performance. IPME provides: a more realistic representation of humans in complex environments, interoperability with other model components and external simulations, enhanced usability through a user-friendly graphical user interface. IPME uses a process-oriented modeling approach and builds upon a SME's accounting of how operator activities are organized or may be organized to meet operational objectives. http://www.maad.com/index.pl/ipme	• Human Systems Integration	• TD-Inputs/Outputs; EMD-Inputs/Outputs
		• Human Factors Engineering	• MSA; TD-Inputs; O&S
JACK	Jack is a human-centric visual simulation software package that enables users to create virtual environments by modeling them natively or importing computer-aided design data, populate their environmentally accurate human fgures, assign tasks to these virtual humans, and obtain valuable information about their behavior. Jack provides a high-fdelity human model, with accurate joint limits, a fully defned spine, fexible anthropometric scaling, and such advanced behaviors as head/eye tracking, natural walking, balance control, seeing, reaching, grasping, bending and lifting. http://www.plm.automation.siemens.com/en_us/products/tecnomatix/assembly_planning/jack/index.shtml	• Human Factors Engineering	• MSA
		• Habitability	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; O&S

Tools

Name	Description	Applicability	
		Domain	Phase
JASS (Job Assessment Software System)	JASS is a computer based survey tool used to identify and rate the level of skills and abilities necessary to perform jobs and job duties. Survey participants provide a rating value for a taxonomy of 50 generic cognitive skills and perceptual-motor abilities. JASS is useful in determining the skills and abilities required to operated and maintain a current system and comparing those required from a proposed new system acquisition, and can be compared to the available population of operators and maintainers. Information on excessive or unique skill demands can be used to influence system design early in the acquisition cycle. http://www.dtic.mil/dticasd/ddsm/tools.html	• Personnel	• All Phases
Job, Task, Function/Workload Analysis	This is a category of tools which allow an analyst to break down the component steps of a process or set of processes to determine how many people are required to do the work, what types of skills are required to do the work, and what type of training is required to enable people to perform the work. Task analysis can include a detailed description of both manual and mental activities, task and element durations, task frequency, task allocation, task complexity, environmental conditions, necessary clothing and equipment, and any other unique factors involved in or required for one or more people to perform a given task. Information from a task analysis can then be used for personnel selection and training, tool or equipment design, procedure design (*e.g.,* design of checklists or decision support systems) and automation. Many different tools can be used to perform these types of analysis. The Federal Office of Personnel Management has a job analysis methodology described at: http://www.opm.gov/HiringToolkit/docs/jobanalysis.pdf. Task Architect is an example of a specific tool which performs these types of analysis. The Task Architect entry in this appendix has additional information on that specific tool.	• Manpower	• MSA; EMD-Outputs; P&D; O&S
LCOM (Logistics Composite Model)	LCOM is one of 21 approved analytical simulation tools in the Air Force's Analytical Toolkit. It is a family of programs consisting of a Data Preparation System, a main simulation program, and a variety of post summary reports and post processors to evaluate the model outputs. It is used to identify the best mix of logistical resources to support a weapon system under certain operational constraints. It is used extensively to determine Air Force maintenance manpower requirements. https://akss.dau.mil/Lists/Software%20Tools/EditForm.aspx?ID=57	• Manpower	• All Phases

Tools

Name	Description	Applicability	
		Domain	Phase
Manpower Typicals	These are "typical" profles of the operations and maintenance manpower associated with specifc Air Force weapon systems. Ordinarily they are used by manpower programming offces to estimate the manpower impacts associated with weapon system movements, and increases or decreases in the amount of a particular weapon system in the Air Force inventory. These are not available on a web site.	• Manpower	• All Phases
Micro Saint Sharp	Micro Saint Sharp is a discrete-event simulation software tool with a graphical user interface and fow chart approach to modeling. Any process that can be represented by a fowchart can be simulated using Micro Saint Sharp. It can be used to answer questions about the costs of alternative training, about how crew workload levels or reaction times affect system performance, and about the allocation of functions between people and machines. The outputs can be used to answer questions about how the system will perform under a variety of conditions. The models can also be used to conduct a sensitivity analysis on the variables in the system. http://www.maad.com/index.pl/micro_saint	• Human Factors Engineering	• MSA
		• Manpower	• EMD-Outputs; P&D; O&S
MIL/CIV PDS (Military/Civilian Personnel Data Systems)	The AF Military Personnel Data System (MILPDS) and DoD Defense Civilian Personnel Data System (DCPDS) are offcial data repositories for personnel information. Information on MILPDS can be obtained from the Air Force Portal https://www.my.af.mil/faf/FAF/fafHome.jsp. Additional information on DCPDS can be found at: http://www.cpms.osd.mil/HRBITS/contentmoddcpds.aspx.	• Personnel	• All Phases
Mishap Risk Assessment Tool	A method of determining the level of mishap risk involved in a system to determine what actions to take to eliminate or control identifed hazards. A good mishap risk assessment tool will enable decision makers to properly understand the level of mishap risk involved, relative to what it will cost in schedule and dollars to reduce that mishap risk to an acceptable level.	• Environment	• MSA
MPES (Manpower Programming and Execution System)	MPES is a web-based resource management portal, database, and accountability tool. It allows Air Force organizations to allocate and track manpower resources. MPES provides an interactive collaborative environment where the system, assisted by powerful web agents, plays an active role in allocating manpower resources and gives analysts the tools they need to manage manpower resources and analyze trends. Information on MPES can be obtained from the Air Force Portal https://www.my.af.mil/faf/FAF/fafHome.jsp	• Manpower	• All Phases
		• Personnel	• All Phases

Tools

Name	Description	Applicability	
		Domain	Phase
MVTA (Multimedia Video Task Analysis)	MVTA analyzes repetitive tasks that have been videotaped. The system enables users to obtain data on repetitions and time from videotape or audio video interleave files. MVTA is used for ergonomic job evaluations, time and motion studies. http://www.nexgenergo.com/ergonomics/mvta.html	• Personnel	• All Phases
NHV (Net Habitable Volume)	NHV is the total remaining volume available to on-orbit crew after accounting for the loss of volume due to deployed equipment, stowage, and any other structural inefficiencies which decrease functional volume. The intent of a minimum NHV requirement is that the vehicle or habitat design provides sufficient contiguous regions of volume for the crew to work, sleep, eat, egress, ingress and perform tasks necessary for a safe and successful mission. This requirement is verified through a combination of measurement and task evaluation, to insure that the vehicle provides a minimum NHV measurement that also represents a usable habitable volume.	• Habitability	• MSA; TD-Inputs/Outputs; EMD-Inputs/Outputs; P&D
ORCA (Operational Requirements-Based Casualty Assessment System)	ORCA provides a methodology for assessing the anti-personnel effects associated with various munitions-produced damage mechanisms. It has the ability to assess the immediate and longer-term capabilities of an operator, and the level of injury caused by the initial result. http://www.dtic.mil/dticasd/ddsm/srch/DDSM0102.pdf	• Human Factors Engineering	• O&S
		• Safety	• TD-Outputs; EMD-Inputs/Outputs
		• Survivability	• TD-Inputs/Outputs
PAL (Parameter Assessment List)	The PAL provides a common but flexible structure and content for Sv assessment of a system. The PAL contains 170 Sv issues related to survival of the soldier and his/her equipment during combat. It is flexible in that assessors may add or delete issues to tailor the PAL to a specific system and its technical characteristics. (Developed by the Army Research Laboratory's Human Research and Engineering Directorate (ARL-HRED). http://www.dtic.mil/dticasd/ddsm/tools.html	• Survivability	• MSA; TD-Inputs/Outputs
PAL-MATE	PAL-MATE is a PC-based automated version of the PAL (see above). PAL-MATE, like the manual PAL, is a comprehensive accounting of what to rate, but not how to rate it. PAL-MATE is intended for performing soldier survivability domain assessments. http://www.dtic.mil/dticasd/ddsm/tools.html	• Survivability	• MSA; TD-Inputs/Outputs

Tools

Name	Description	Applicability	
		Domain	Phase
PESHE Checklist (Programmatic Environment, Safety and Occupational Health Evaluation)	The PESHE document is a management tool used to help PMs identify and manage ESOH hazards and risks, and determine how best to meet ESOH regulatory requirements and DoD standards. It is a living document that is continually updated and maintained throughout the progression of a program or project, from concept to disposal. Because the PESHE is a program document, it is not intended to supersede or replace other ESOH documents.	• Environment	• MSA; TD-Outputs; EMD-Inputs/Outputs; P&D
		• Safety	• TD-Outputs; EMD-Inputs/Outputs
		• Occupational Health	• TD-Outputs; EMD-Inputs/Outputs; P&D
RADGUNS (Radar-Directed Gun System Simulation)	RADGUNS is used to evaluate the effectiveness of Air Defense Artillery (ADA) gun systems against penetrating aerial targets. It is also used to evaluate the effectiveness of different airborne target characteristics against a specific ADA system. RADGUNS is a complete one-on-one simulation including weapon system, operators, target model, flight profiles, environment, electronic attack, and endgame. http://www.bahdayton.com/surviac/radguns.htm	• Survivability	• TD-Inputs/Outputs; EMD-Inputs/Outputs
REHMS-D (Reliable Human-Machine System Developer)	REHMS-D uses a six-stage system engineering process, a cognitive model of the human, and operational sequence diagrams to assist the designer in developing human-machine interfaces subject to top-level reliability or yield requirements. Through its system engineering process, REHMS-D guides the designer through the understanding of customer requirements, the definition of the system, the allocation of human functions, the basic design of human functions, the assignment of job aids, and the design of tests to verify that the human functions meet the allocated reliability requirements. http://www.dtic.mil/dticasd/ddsm/closed/DDSM0188.pdf	• Human Factors Engineering	• O&S
RiskSafe 7	RiskSafe 7 conducts qualitative workplace job safety analysis assessments for specific tasks or activities. RiskSafe 7 enables safety engineers or ergonomists to rank relative risk, using values of probability and consequences to define decision criteria. This tool will identify and mitigate factors that may lead to an unsafe workplace. http://www.dyadem.com/products/risksafe/index4.htm	• Safety	• EMD-Outputs; P&D; O&S

Tools

Name	Description	Applicability	
		Domain	Phase
SAFEWORK	SAFEWORK(tm) is a 3D design analysis software for analyzing the interaction between humans and their workspace. This powerful human modeling tool creates virtual male or female mannequins of various percentiles, based on U.S. Army statistics. The software is designed to resolve ergonomic problems during design. SAFEWORK is fully embedded in Dassault Systems V5 architecture and supports ENOVIA, CATIA and DELMIA. SAFEWORK(tm) allows the user to analyze the mannequins' ability to function within an imported CAD design. http://www.dtic.mil/dticasd/ddsm/tools.html	• Human Factors Engineering	• EMD-Outputs
SAGAT (Situation Awareness Global Assessment Technique)	SAGAT provides an objective measure of situation awareness by directly comparing operators' reported SA to reality. With this technique, a human-in-the-loop simulation is frozen at randomly selected times while operators answer questions about their current understanding of the situation. Operators' perceptions are then compared to the real situation (based on information drawn from the computer or from subject matter experts who answer the SAGAT queries while looking at the displays). http://www.satechnologies.com/services/measurement/SAGAT	• Human Factors Engineering	• P&D
SALT (Spatial Analysis and Link Tool)	SALT is a tool for examining the implications of various layout options. SALT allows users to import a drawing of the intended space to place people and other resources in the scene, and then to create links between them. It is used for design and optimization of command and control environments or other environments where efficiency is important. http://www.sonalysts.com/training/case_studies/index.html	• Human Factors Engineering	• TD-Outputs
SAMMIE	SAMMIE is a computer-based human modeling tool that is used for design and layout of equipment and furniture in offices and homes, aircraft cockpits and cabins, design of control panels, field of view analysis, reflection and mirror evaluations, and safety and maintenance evaluations. The system offers 3D analyses of fit, reach, vision and posture. http://www.lboro.ac.uk/departments/cd/research/groups/erg/sammie/samdesc.htm	• Human Factors Engineering	• TD-Outputs
Scale Mockups	A mockup is a scale or full-size non-functional model of a structure or device, used for teaching, demonstration, testing a design, promotion, *etc.* A software mockup will look and feel like the real thing, but will not do useful work beyond what the user sees. In many cases it is best to design the user interface before code is written or hardware is built, to avoid having to go back and make expensive changes.	• Habitability	• EMD-Inputs/Outputs; P&D; O&S

Tools

Name	Description	Applicability	
		Domain	Phase
SurveyWIN/EZSurvey	EZSurvey for the Internet, SURVEYWin, and InterForm, are electronic questionnaire authoring software. EZReport and RapidReport both provide data reporting and exporting capability. These software applications are used for large-scale evaluations, assessments, profiles, employee reviews, and customer satisfaction, plus factual data collection. InterForm is the new advanced Web application developer. http://www.vovici.com/products/feedback-survey-software.aspx	• Human Factors Engineering	• O&S
Task Architect	Task architect is a computer program designed to increase efficiency through faster data collection and analysis of tasks. The program helps users identify information about tasks which drive decisions about systems design, reducing human error, training needs analysis, documentation, user interface design, and Human Systems Integration. http://www.taskarchitect.com	• Personnel	• All Phases
TDFA (Top-Down Functional Analysis)	Top-Down Functional Analysis is a term the Navy uses for their functional analysis associated with systems engineering and acquisition processes. The Navy also has a web-based tool associated with this analysis called Trade Space for Systems Analysis (see TSSA).	• Personnel	• All Phases
TSSA (Trade Space for Systems Analysis)	TSSA is a web-based derivative of the Navy's TDFA. It includes a relational database which allows analysts to decompose functions while also associating any number of attributes. It provides allocation assistance for decisions in multiple trade spaces such as non-recurring costs, life cycle costs, manpower, performance, and safety. It can interface with existing systems engineering tools such as Telelogic's DOORS®. http://www.sonalysts.com/training/case_studies/index.html	• Safety	• TD-Inputs
VACP (Visual, Auditory, Cognitive and Psychomotor)	Raters assign a value from zero to seven for workload in each visual, auditory, cognitive, and psychomotor workload category. Any time a workload value exceeds 7 for visual, auditory, cognitive, or psychomotor, the person is considered to have exceeded his or her workload capacity for that particular resource (McCracken and Aldrich, 1984). The VACP algorithm is what is most frequently used by IMPRINT software to calculate workload. (AFRL-HE-WP-TR-2006-0148, A Survey of Tools Supporting NAVSEA Warfare Center Human-System Integration Activities (based on the work of McCracken and Aldrich, 1984). http://www.dtic.mil	• Human Factors Engineering	• P&D; O&S

Tools

Name	Description	Applicability	
		Domain	Phase
VAPS	VAPS is designed for the development of dynamic interactive real-time graphical human-machine interfaces for complex applications, including the displays and controls found in the cockpit of an aircraft as well as in automobile instrumentation. http://www.presagis.com/products/hmi/details/vaps	• Human Factors Engineering	• TD-Outputs
VESARS (Virtual Environment Situation Awareness Rating System)	VESARS collects data on a person's situation awareness during scenarios in a virtual reality simulator. Feedback is then provided to demonstrate where situation awareness may be weak and how to fne tune the processes being used to gather and interpret information. VESARS includes objective measures of situation awareness such as SAGAT and real-time probes, as well as measures of the processes and communications techniques being employed. http://www.satechnologies.com/services/training/VESARS	• Training	• EMD-Inputs
Watchstander Model	The Watchstander Model is a discrete event simulation of a particular ship design including the systems and crew member's actions in stressful tactical scenario. The WSM produces crew workload; including task queuing and shedding indicators, as well as tactical measures of performance such as ship response latency to tactical situations. These data are then used to assess crew manning concepts as well as ship systems design, and to help target areas requiring design improvements. http://www.maad.com	• Human Factors Engineering	• EMD-Inputs

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